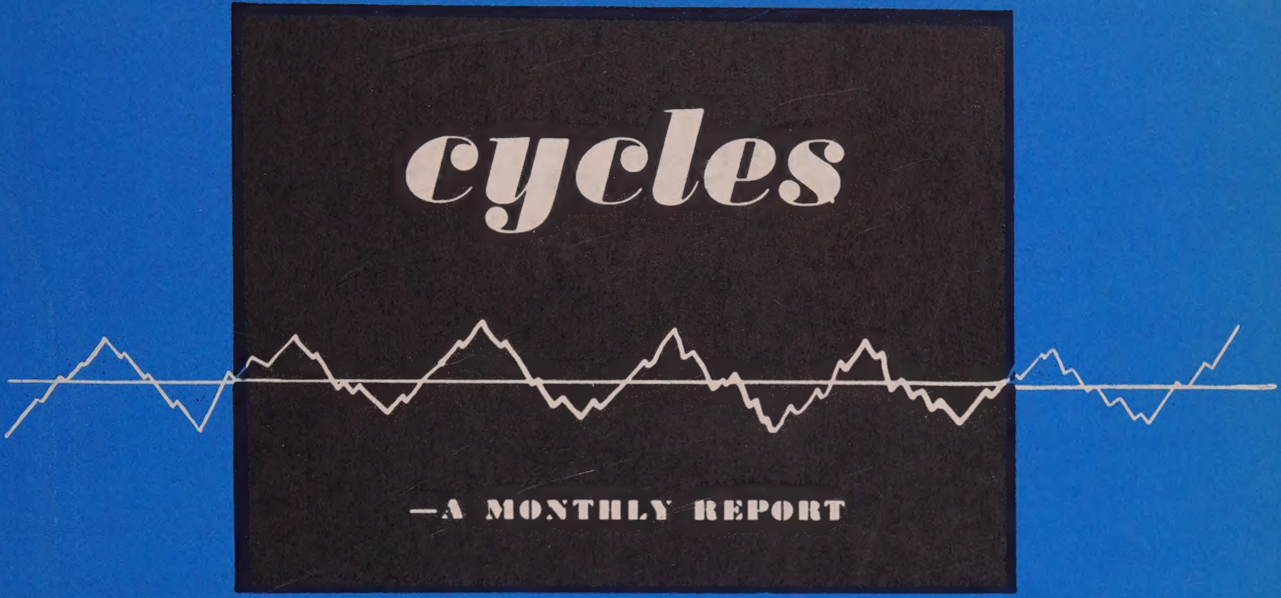

cycles

—A MONTHLY REPORT

September 1953

FOUNDATION FOR THE STUDY OF CYCLES
New York, New York

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cycles
—a monthly report

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VOLUME IV NUMBER 7 SEPTEMBER 1953

The Director's Letter

Dear Member:

About 1902 or 1903, when I was a boy, and when the horseless carriage was beginning to occupy public attention, there appeared in the *Saturday Evening Post* a continued story centering around one of the earlier automobiles. The story was laid in France. There was of course a beautiful American girl involved—and a dashing young Frenchman—but the automobile was the center of interest.

Two things about the story I remember with great vividness, both of them bearing an allegorical relationship to the study of cycles.

A Gift

First of all, the automobile came into the girl's possession as a gift. The darned thing was so cantankerous and exasperating —so provoking, so infuriating—that its original purchaser gave up just as the girl and her family came along. "I never want to see this pesky contraption again!" the owner said. "Sometimes it will run, but mostly it won't. I can't figure out what's wrong with it. It's diabolical. I'm through. If you want it, take it. It's yours and may God bless you."

Now, by and large, that is what old fashioned science has said about cycles. Scientists have found cycles almost everywhere and have studied cycles, but the subject is so baffling and so provoking that most of them have given up. Cycles appear in thickness and thinness of tree rings, in the abundance of animals, in prices, in weather, in factory production, in disease, in crime, and in dozens of other phenomena. They "run" for awhile, and then they quit or change their wave lengths. Or, worse yet, reverse and continue upside down. "We're through!" said old time Science. "If you want cycles, take them. May God bless you, and keep you from going crazy!"

The Great Race

The other thing that I remember about the automobile story is the great race. The girl's family took the car. They found a young (and handsome) French mechanic who could make the thing run, after a fashion. Finally they decided to enter it in a race.

In those days automobile races were not so much speed contests as destination contests; not so much a question of how fast you got there as whether or not you could get there at all.

Well, the race finally came off. The various cars started. One by one they broke down. They were repaired and started up again. First one was ahead. Then another. More breakdowns. Some complete eliminations. Some revivals. Would any of them make the finish line? Could the dashing young French mechanic with the ticklish moustache make Betsy run well enough to win?

Of course in the story Betsy did win, but only because the Frenchman hopped out of the car, wrench in hand, and, steering with one hand as he ran along beside the gasping vehicle, used his other hand to make enough adjustments to keep her moving and thus over the finish line to glory.

I see a good deal of correspondence between the young French mechanic and myself. Of course I an neither young nor dashing, nor do I have a ticklish moustache, but essentially I am trying to do what Frenchy did—I am trying to find out enough about cycles to make them work, and then to run along beside the various cycle projections and tinker with them as we go along together to the end that I can *keep* them running—that is to say, true them up from time to time so that they will forecast the future better than not.

In the story Frenchy succeeded, but that was a story. This is real life. Whether or not I will succeed I do not know, but if I fail someone after me *will* succeed, for there *is* reality to cycles, just as there is reality to automobiles, even if we do not yet know as much about cycles as we knew about cars in 1902.

****

The 54-Year Cycle in Prices

One of the cycles I would like to run along beside and tinker with before a false projection matters one way or another is the great 54-year cycle, first observed and reported upon by Professor N. D. Kondratieff in an article called "Die langen Wellen der Konjunktur" which appeared in the *Archiv fur Sozial-Wissenschaft und Sozialpolitik* in 1926.

This article is so important, and of such great historical interest, that I plan to publish a translation of it as a supplement to a forthcoming report.

In a nut-shell, Kondratieff observed that commodity prices in England, France, and the United States, the price of English consols and French rente, the wages of textile workers and agricultural workers in England, the production of coal, lead, and pig iron in England, the consumption of coal in France, and various other indexes of price, production, and consumption, varied in a cycle about 50 or 60 years in length.

By a stroke of rash and intuitive genius Kondratieff concluded that these waves were cycles which could be expected to continue. In discussing the question of significance Kondratieff said, "Is it possible to maintain that the existence of long cycles in the dynamics of the capitalist economy is proved on the basis of the preceding statements? The relevant data which we were able to quote cover about 140 years. This period comprises two and one-half cycles only. Although the period embraced by the data is sufficient to decide the question of the existence of long waves, it is not enough to enable us to assert beyond doubt the cyclical character of those waves. Nevertheless we believe that the available data are sufficient to declare this cyclical character to be very probable."

In the book *Cycles—the Science of Prediction* written in 1944 by E. F. Dakin and myself, we devoted an entire chapter to a discussion of this cycle. As a result of work with longer series of figures than were available to Kondratieff, we concluded that its length was quite close to 54 years. In wholesale prices *in terms of gold* we set the ideal time of low in the early 1950's. No further work has changed the conclusions reached at that time.

The 54-Year Cycle in Production

However, *and this is very important*, work that I have done since *Cycles* was written has convinced me that the 54-year cycle in *production* has a very different timing from the 54-year cycle in *prices*. In those series of figures I have studied the 54-year cycle in *production* had its last crest in the first decade of this century and its last trough in the 1930's. The downward force of this cycle is, in my opinion, the cause of the flattening of the growth trend in certain production series from about 1910 to 1939. The upward force of this cycle is, in my opinion, one of the causes of the golden era in which we have found ourselves, economically, from about 1935 to date. I believe that, with minor reversals (which will doubtless seem like major ones at the time), this upsurge will continue until after the 1960's, *after which growth curves will seem to flatten again.*

I believe the great depression of the 1930's was cyclicly related to the bad times ushered in by the panic of 1873, to the hard times in the 1820's and 1830's and to the economic disturbances which were one of the causes of the revolutionary war.

I believe we are unlikely to have depression equal in magnitude to the depression of the 1930's until sometime in the 1980's; but of course we are likely to have minor depressions aplenty.

I believe these things, but I do not know them. To *know* we need to make many studies of long series of figures, for cycles can not be depended upon unless they have repeated themselves with *enough* dominance and *enough* regularity *and enough* times so that they cannot reasonably be the result of chance.

I hope to make such studies and confirm or modify this forecast before it makes much difference one way or the other. Like Frenchy and his automobile, as we run along together, the forecast and I, I hope to tinker with it, if necessary, before it goes bad for lack of proper adjustment. But in the meantime I feel it gives you the best general perspective and orientation possible to obtain at this time.

● ● ●

Thinking Versus Knowing

I never say that I *think* something or other that I am not reminded of John Ruskin's statement to the effect that it is the duty of the artist to *feel*, the duty of the writer to *think*, and the duty of the scientists to *know*. Like any aphorism this one oversimplifies a complex subject, but it is close enough to the truth to make me squirm when I get my feet off the solid ground of what I *know* and into the nebulous and uncertain area where I merely think.

What I Know

Well then, what *do* I know?

First of all, I *know* that a great many things act as if they were influenced by regularly recurring cyclic forces. These things include stock and commodity prices, the production of various industries and of individual companies, the number of earthquakes, the abundance of mammals, insects, birds, and fish, the thickness and thinness of annual tree rings and annual sedimentary rock deposits, the course of ocean currents, the levels of inland lakes, the yield and the acreage of crops, the incidence of disease, the tendency of people to join churches and to fight battles, the electric potential of trees, variation of rainfall, temperature, and barometric pressure, and radio weather, the run-off of rivers, the number and area of sunspots, the severity of magnetic storms, the births of infants, and the amorousness of women.

I *know* that some of the rhythmic regularities observed could be the result of random forces, but it is inconceivable to me that all of them are.

I *know* that where you have a series of fluctuations not the result of random forces you have the right to assume an underlying cause, but I see no reason why you should try to find the same cause for different sorts of fluctuations. Sunspots could be (and probably are) the cause of variations in terrestrial magnetism; the moon is at least one cause of the tides; work done recently suggests that the planets might be partly associated with some of the cycles in radio weather. Cycles in other things may have other causes.

I *know* that if, in any sort of phenomenon, the regularity of fluctuation is caused by a non-random force, and if we do not know what that force is or how it operates, we do not know all that is to be known about the phenomenon in question.

I *know* that if our economy, for example, is influenced by rhythmic environmental forces, as seems to be the case, any theories of economics which fail to take these forces into account are at least partly in error, just as, if there are such things as germs, pre-1677 theories of medicine were necessarily partly false.

Some Self Evident Observation

It also seems obvious to me that in a situation where centralized authority is more and more being called upon to interfere in economic affairs, it is of increasing importance that the men controlling this authority know enough to take the right sort of action at the right time. This is not the case today, according to Dr. Arthur F. Burns, of the President's Council of Economic Advisors. "The ability of Government to control depressions is not yet assured", says Dr. Burns. He adds, "If the Government intervenes to counteract a business downturn, it might do the wrong things because of imperfect knowledge and understanding." If a man of Dr. Burns' stature does not know, imagine the inadequacy of lesser men, who do not even know that they do not know.

It likewise seems self-evident that if government is responsive to mass opinion, the electorate should know at least enough about the cause of price and production fluctuation so as to place blame where blame is due. The woman who blamed Mr. Eisenhower for the rain was doubtless joking, but the people who blamed Mr. Hoover for the 1932 depression were serious.

The Future

That is why the study of cycles seems to me to be so terribly important. God willing, and with your continued interest, day by day we are creeping ahead.

Cordially yours,

Edward R. Dewey

Director

P.S.-Our last report evoked an amusing interchange with the Post Office Department.

As you know, we issue ten reports a year. No reports are issued for July and August.

Some people do not understand this. When they arrange their reports in order and find no reports for July and August, they write in to ask about the missing reports.

To clarify the situation, we decided to call our sixth report our June-July report, and our seventh report our August-September report. In this way, even though we issued but ten reports, the names of all twelve months would be on the covers.

But we reckoned without Bureaucracy.

When we presented out June report for mailing, the Post Office Department refused to accept it, "Because," they said, "it is not one report, it is two reports, and you previously told us that you planned to issue only ten reports a year. Now you are issuing eleven reports. You cannot do this. We will not accept your reports for mailing."

"But it *is* only one report," we said. "Can't you see? It has but the usual forty pages. It has but one cover. It has no internal divisions."

"No," said the Post Office Department, "it is *two* reports. It says June-July on the cover."

"If we put June-July-August-September-October-November-December on the cover would it be seven reports?" we said. "If we left the name of the month off the cover would it be *no* report?"

"It is *two reports*," said the Post Office Department. "We won't mail it. We may revoke your mailing privileges. The least that can happen is that you will be fined."

Eventually, however, they relented and mailed the issue. We still have our mailing privileges, and have not yet been fined.

Now you know why the June issue was late.

But be careful not to give your son a compound name like John Henry, lest the government consider him two people and tax him accordingly. Be careful not to marry a girl named Mary Louise, lest the govennment arrest you for bigamy.

Hiel Hitler!

• • •

Neal Heines, president of the Solar Division of the American Association of Variable Star Observers, writes that the future of the sunspot number program, hiterto supported by the National Bureau of Standards, is very, very uncertain. The Bureau of Standards writes that they believe the program should be continued but, due to the economy drive, they are unable to continue to give the five or six thousand dollars a year necessary to continue it. If you wish to contribute to a fund to carry on this work, get in touch with Mr. Neal J. Heines, 560 Broadway, Paterson 4, New Jersey.

Research

BETHLEHEM STEEL CORPORATION
6-YEAR CYCLE IN PRODUCTION

FROM 1905 to date Bethlehem Steel Company production in net tons is characterized by a recurring cycle, 6 years from crest to crest and from trough to trough. See Fig. 1 which shows a chart of these data, with a 6-year moving average trend, and arrows to indicate ideal 6-year crests. See also Fig. 2 which shows the 6-year cycle by itself, as percentage deviations from the 6-year moving average trend. Fig. 2 shows the percentages by which the actual values for each year are above or below the average of the 6-years centering on that year.

Not Easily the Result of Chance

This 6-year cycle in these figures has repeated enough times and with enough dominance and with enough regularity so that it cannot easily be the result of chance. It should therefore be taken into account as a probability for the future.

The 6-Year Cycle in Natural Phenomena

The presence of a cycle of this length in natural phenomena strengthens the idea that the ultimate cause of this behavior is not within the steel industry or even within our economy. Something seems to stimulate us human beings for three years and then to depress us for a like period. What this *something* is is not yet known.

A Compound Cycle

A study of the 6-year cycle in over 200 years of cotton prices suggests that what we see in Bethlehem Steel production, and in dozens of other series of price, production, and sales figures, is not quite as simple as appears on the surface. Instead of a basic rhythm of 6-years which will keep on going forever, it looks as if the 6-year behavior were the result of cyclic forces slightly longer than 6-years and slightly shorter which have blended for the past fifty or sixty years so as to give a 6-year result. If this is the true explanation, we can expect the 6-year cycle in Bethlehem Steel production figures and in other economic figures to fade out eventually. In the meantime however it is a useful tool to throw light on what is ahead.

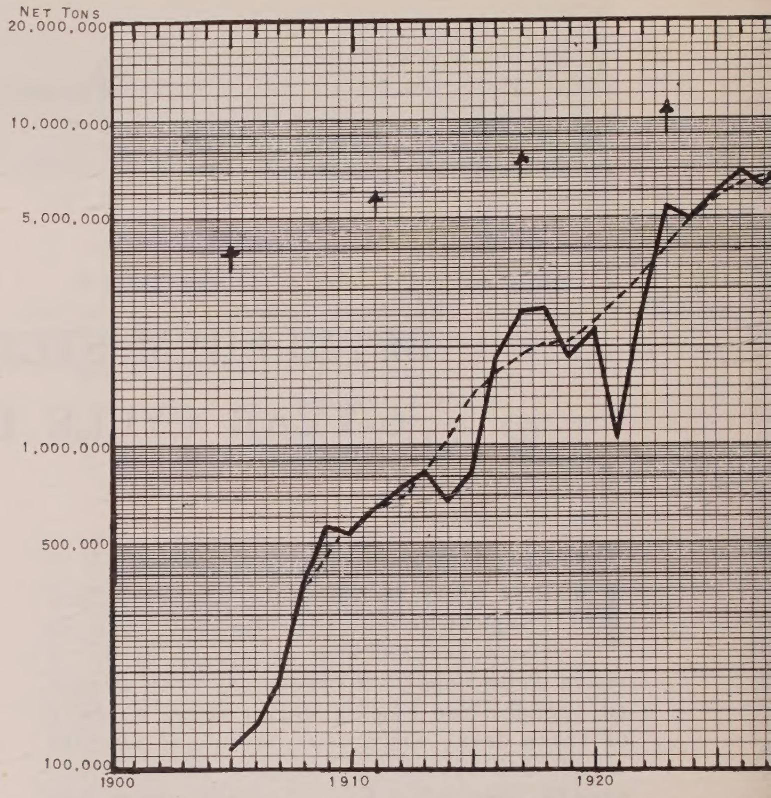
A 6-year cycle in economic affairs was first discovered, as far as I know, by Chapin Hoskins in 1937. The fact that it has been coming true ever since strengthens the idea that it is not the result of random forces, but that the 6-year cycle in such figures has significance.

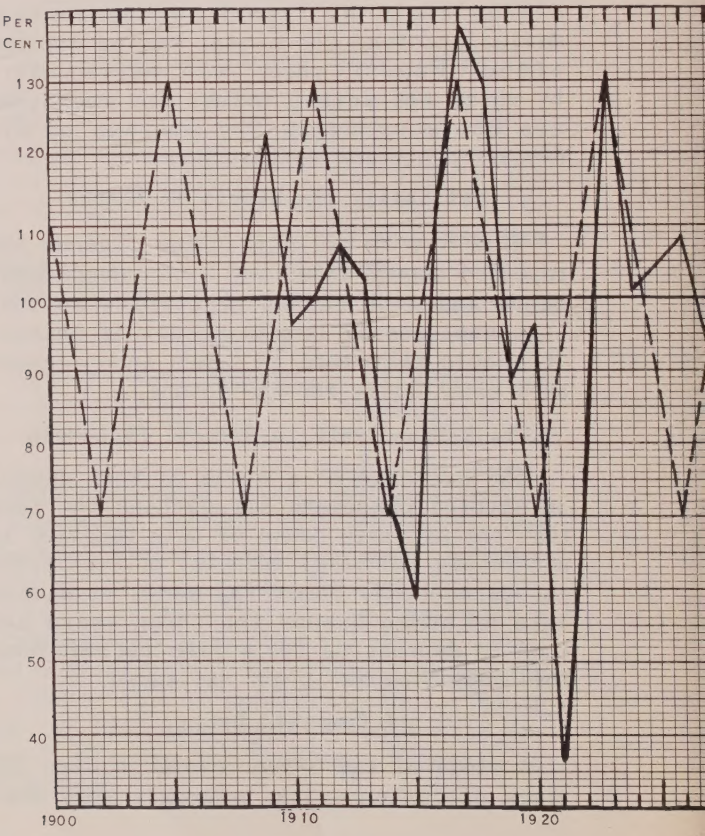
The 6-year cycle in Bethlehem Steel production was first discovered in 1949.

The Typical 6-Year Cycle

Typically the 6-year cycle in Bethlehem production has been as follows:

Year of crest	116.7%	of its trend
1st year after crest	111.9%	of its trend
2nd year after crest	98.4%	of its trend
3rd year after crest	89.3%	of its trend
4th year after crest	87.1%	of its trend
5th year after crest	100.0%	of its trend


NET TONS
20,000,000
10,000,000
5,000,000
1,000,000
500,000
100,000
1900
1910
1920


PER CENT
130
120
110
100
90
80
70
60
50
40
1900
1910
1920

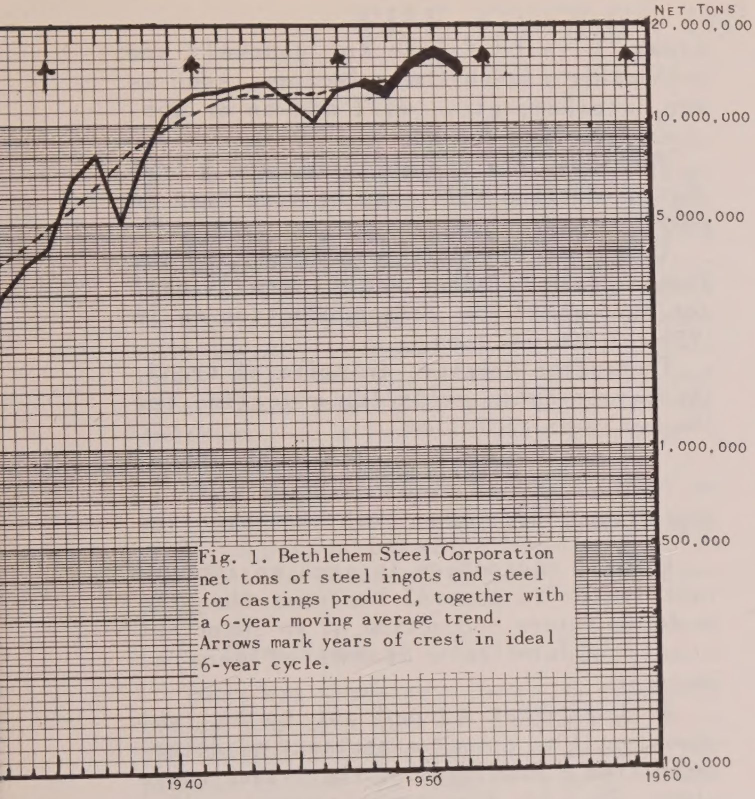


Fig. 1. Bethlehem Steel Corporation net tons of steel ingots and steel for castings produced, together with a 6-year moving average trend.
Arrows mark years of crest in ideal 6-year cycle.

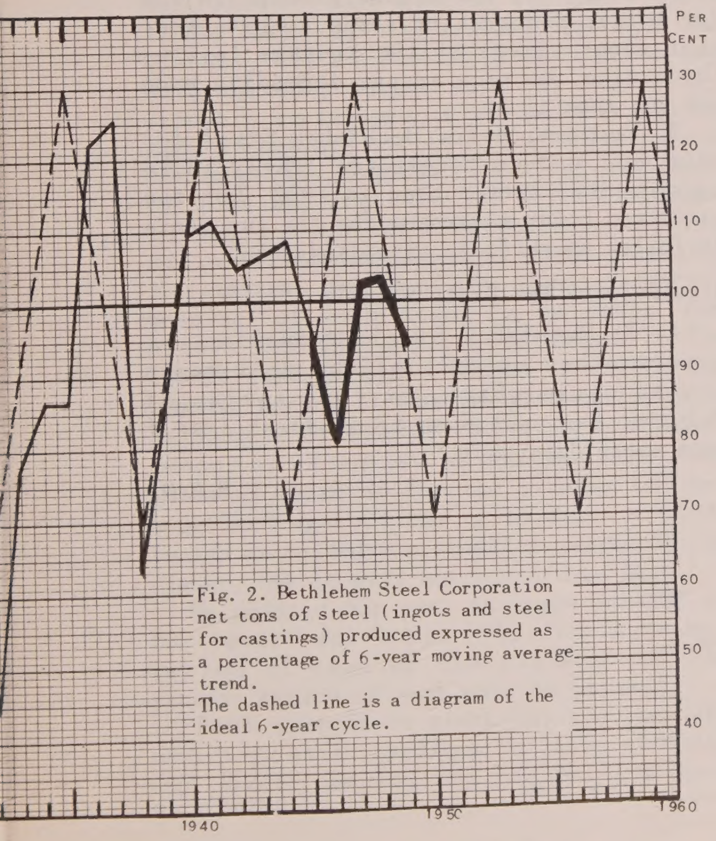
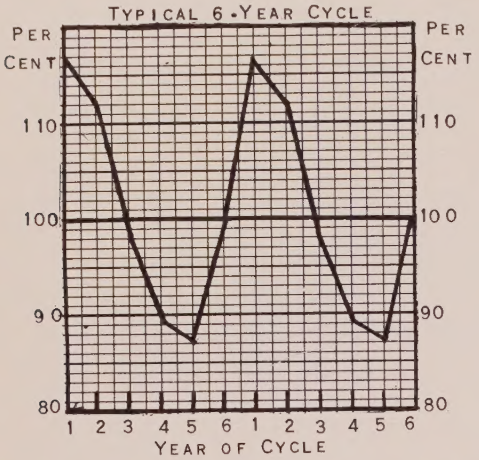


Fig. 2. Bethlehem Steel Corporation net tons of steel (ingots and steel for castings) produced expressed as a percentage of 6-year moving average trend.
The dashed line is a diagram of the ideal 6-year cycle.

These values are shown on the following chart:



Years of crest have been, ideally, 1905 and every six years thereafter. Years of trough come four years later.

(The diagram on pages 216 and 217 shows troughs three years later as determined in 1949 when this cycle in these figures was first observed.)

Other Cycles Also Present

There are other cycles present in Bethlehem production. When these have been isolated we can make a better determination of trend and a better projection into the future. Then there are other non-rhythmic factors such as war and preparation for war and peace about which your guess is likely better than mine. As far as the trend and the 6-year cycle govern, however, and assuming that both are as determined and will continue, the probabilities are as follows:

Probabilities for 1953 and 1954

For 1953, the probabilities are 3 to 1 that production will be better than normal. Probabilities are 6 to 1 that production for 1953 will be above production for 1952. The composite effect of growth as presently determined and the 6-year cycle would call for production of 17,800,000 tons in 1953. When we know more about the other cycles in Bethlehem, this estimate can be improved. The trend can be determined more accurately and the other cycles can be included in the projection, but you will always have to figure for yourself how much other non-rhythmic factors, such as war, strikes, etc., will add to or subtract from this amount.

For 1954, the probabilities are 5 to 2 that production will also be more than in 1952.

Trend, as presently determined, and the 6-year cycle together would normally call for just about the same production as in 1953, 17,800,000 tons.

Thereafter however, in spite of trend, the 6-year cycle calls for a decline for the two years to follow.

Significance

Significance For You

1. Steel production is such an important factor in general business that the probable future production of an important steel company is a matter of general interest.

2. Last year turned out to be just about equal to normal expectancy as determined from a knowledge of the 6-year cycle alone. That is, the excess tonnage called for by war preparation seems to have been just about offset by the tonnage lost by the strike, or vice versa, depending upon how you look at it.

3. Production for Bethlehem Steel for this year and next year are likely to be considerably better than in 1952, but the situation holds a warning for the two years to follow thereafter. (1955 and 1956).

Significance For Cycle Study

1. In Bethlehem Steel production, we have another example of the well known 6-year cycle which, in this series of figures, has continued to manifest itself ever since discovery.

E.R.D.

THE CYCLES OF THE PLANETS

IT has often been suggested that at least some of the cycles observed on the sun and on the earth might have lengths corresponding to harmonics or unit fractions of a planetary cycle. If this should turn out to be true, and it were not mere coincidence, it would suggest a possible interrelationship, either a cause and effect relationship of some sort—perhaps indirect, or a relationship based on a common cause.

This clue—once we had it—would be worth running down, especially if anyone could suggest a reasonable hypothesis as to how such an interrelationship might come about.

Three Kinds of Planetary Cycles

There are three main sorts of planetary cycles. One main kind of planetary cycle is the length of time required by each of the planets to make one complete circle of the sun. Another main kind of planetary cycle is the length of time required for each two planets, now in line with each other and with the sun, to get into the same relationship again—one of the planets having made a complete circuit of the sun in the meantime. The third main kind of planetary cycle is the time required for each planet to make a complete revolution around its own axis. The first kind of cycle is called the *sidereal* period of the planet (*sidereal* meaning "of or relating to the stars" and *period* meaning cycle wave length). The second type of cycle length is called the *synodic* period of the two planets (*synodic* is from a Greek word meaning *assembly;* hence, by extension of meaning, the time interval required for the planets to "get together" again.) The third sort of cycle length is called the *rotation* period of the planet, but it will not concern us here.

We printed for you, on pages 135-137 of our report for April 1951, the sidereal period of each of the planets and the synodic period of each pair of planets.

I now propose to print for you the harmonics or unit fractions of these sidereal and synodic periods, for lengths of 4 years or greater.

Unit Fractions

Unit fractions are fractions in which the numerator (upper part) is 1 and the denominator (lower part) is a whole number. For example, 1/2, 1/3, 1/4, 1/5, etc. are unit fractions. Unit fractions are often called harmonics, the unit fraction 1/2 being called the second harmonic, the unit fraction 1/3 being called the third harmonic, etc.

I am printing these unit fractions for you chiefly because I want you to realize that, as soon as you start to study the shorter cycles, you can find a unit fraction of a planetary cycle close to almost any cycle you could find or imagine. And, as yet, in most instances, we just cannot measure the length of observed cycles accurately enough to say for sure that the length of the observed cycle is or is not the length of one of the planetary harmonics.

The Presidents and the Mice

Moreover, let me emphasize that even though two phenomena fluctuate in cycles of *identical* length (time span from crest to crest or from trough to trough) there is no *necessary* relation between them. The two cycles may have the same length merely by accident. For example, there is a plague of mice in central New York State which recurs at 4-year intervals. There is also a 4-year cycle of presidential elections. In fact, the "crash" of the mouse cycle coincides with the actual year of presidential elections. But in spite of all this correspondence no one that I know of has yet blamed our presidents for our plagues of mice, or blamed the mice for the coming of our presidents. Thus you see that identical cycle lengths in different phenomena do not *prove* cause and effect or even common cause relationship. However, in many instances, corresponding cycle lengths, if actually identical, *suggest* the possibility of interrelationship.

The sidereal period (time required for one complete revolution around the sun) of each of the planets is given in Table 1.

Table 1
Sidereal Period

Planet	In Days	In Months	In Years
Mercury	87.9686	2.89	.2408
Venus	224.7007	7.38	.6152
Earth	365.2564	12.00	1.0004
Mars	686.9804	22.57	1.8808
Jupiter	4,332.5870	142.34	11.86
Saturn	10,759.2025	233.48	29.46
Uranus	30,685.93	1,008.14	84.01
Neptune	60,187.64	1,977.38	164.78
Pluto	90,737.	2,981.0	248.42

Table 2
Harmonics, 4 Years Long or Longer, of Sidereal Periods of the Planets, in Years

Harmonic	Pluto	Neptune	Uranus	Saturn	Jupiter
1	248.42	164.78	84.01	29.46	11.86
1/2	124.210	82.39	42.005	14.73	5.93
1/3	82.807	54.927	28.003	9.82	3.95
1/4	62.105	41.195	21.002	7.365	
1/5	49.684	32.956	16.802	5.892	
1/6	41.403	27.463	14.001	4.910	
1/7	35.489	23.540	12.001	4.209	
1/8	31.053	20.597	10.501		
1/9	27.602	18.308	9.334		
1/10	24.842	16.478	8.401		
1/11	22.584	14.980	7.637		
1/12	20.702	13.732	7.001		
1/13	19.109	12.675	6.462		
1/14	17.744	11.777	6.001		
1/15	16.561	10.985	5.601		
1/16	15.526	10.299	5.251		
1/17	14.613	9.693	4.942		
1/18	13.801	9.154	4.667		
1/19	13.075	8.673	4.422		
1/20	12.421	8.389	4.200		
1/21	11.830	7.847	4.000		
1/22	11.292	7.490			
1/23	10.801	7.164			
1/24	10.351	6.866			
1/25	9.937	6.591			
1/26	9.555	6.338			
1/27	9.201	6.103			
1/28	8.872	5.885			
1/29	8.566	5.682			
1/30	8.281	5.493			
1/31	8.014	5.315			
1/32	7.763	5.149			
1/33	7.528	4.993			
1/34	7.306	4.846			
1/35	7.098	4.708			
1/36	6.901	4.577			
1/37	6.714	4.454			
1/38	6.537	4.336			
1/39	6.370	4.225			
1/40	6.211	4.120			
1/41	6.059	4.019			
1/42	5.915				
1/43	5.777				
1/44	5.646				
1/45	5.520				
1/46	5.400				
1/47	5.286				
1/48	5.175				
1/49	5.070				
1/50	4.968				
1/51	4.871				
1/52	4.777				
1/53	4.687				
1/54	4.600				
1/55	4.517				
1/56	4.436				
1/57	4.358				
1/58	4.283				
1/59	4.211				
1/60	4.140				
1/61	4.072				
1/62	4.007				

The unit fractions or harmonics in years (down to 4 years) of the lengths given in Table 1, for each of the above planets are given in Table 2.

The synodic periods of the slower planets, in years, and their unit fractions, down to four years are given in Table 3 (the faster planets have synodic periods of less than four years).

Table 3

Harmonics, 4 Years Long or Longer, of Synodic Periods of the Planets, in Years

Harmonic	Neptune & Pluto	Uranus & Neptune	Uranus & Pluto	Saturn & Uranus	Saturn & Neptune	Saturn & Pluto	Jupiter & Saturn	Jupiter & Uranus	Jupiter & Neptune	Jupiter & Pluto
1	492.	171.4	127.1	45.36	35.87	33.43	19.86	13.81	12.78	12.46
1/2	246.	85.70	63.55	22.68	17.935	16.715	9.93	6.905	6.39	6.23
1/3	164.	57.13	42.37	15.12	11.957	11.143	6.62	4.603	4.26	4.153
1/4	123.	42.85	31.77	11.340	8.967	8.357	4.965			
1/5	98.4	34.28	25.42	9.072	7.174	6.686				
1/6	82.0	28.56	21.183	7.560	5.978	5.571				
1/7	70.3	24.48	18.157	6.480	5.124	4.776				
1/8	61.5	21.43	15.887	5.670	4.483	4.178				
1/9	54.6	19.04	14.122	5.040						
1/10	49.2	17.14	12.710	4.536						
1/11	44.7	15.58	11.555	4.124						
1/12	41.0	14.28	10.591							
1/13	37.85	13.18	9.777							
1/14	35.14	12.24	9.078							
1/15	32.80	11.43	8.473							
1/16	30.66	10.71	7.943							
1/17	28.94	10.08	7.476							
1/18	27.33	9.52	7.061							
1/19	25.89	9.02	6.689							
1/20	24.60	8.570	6.355							
1/21	23.43	8.162	6.052							
1/22	22.36	7.791	5.777							
1/23	21.39	7.452	5.526							
1/24	20.50	7.142	5.295							
1/25	19.68	6.856	5.084							
1/26	18.95	6.592	4.888							
1/27	18.22	6.348	4.707							
1/28	17.571	6.121	4.539							
1/29	16.966	5.910	4.382							
1/30	16.400	5.713	4.237							
1/31	15.871	5.529	4.100							
1/32	15.37	5.356								
1/33	14.909	5.194								
1/34	14.47	5.041								
1/35	14.057	4.897								
1/36	13.66	4.761								
1/37	13.297	4.632								
1/38	12.95	4.510								
1/39	12.615	4.395								
1/40	12.30	4.285								
1/41	12.000	4.180								
1/42	11.71	4.081								
1/43	11.44									
1/44	11.18									
1/45	10.933									
1/46	10.695									
1/47	10.468									
1/48	10.250									
1/49	10.041									
1/50	9.840									
1/51	9.647									
1/52	9.461									
1/53	9.283									
1/54	9.111									
1/55	8.945									
1/56	8.786									
1/57	8.632									
1/58	8.483									
1/59	8.339									
1/60	8.200									
1/61	8.065									
1/62	7.935									
1/63	7.810									
1/64	7.688									
1/65	7.569									
1/66	7.455									
1/67	7.343									
1/68	7.235									
1/69	7.130									
1/70	7.029									
1/71	6.930									
1/72	6.833									
1/73	6.740									
1/74	6.649									
1/75	6.560									
1/76	6.474									
1/77	6.390									
1/78	6.308									
1/79	6.227									
1/80	6.150									
1/81	6.074									
1/82	6.000									
1/83	5.928									
1/84	5.857									
1/85	5.788									
1/86	5.721									
1/87	5.655									
1/88	5.591									
1/89	5.528									
1/90	5.467									
1/91	5.407									
1/92	5.348									
1/93	5.290									
1/94	5.234									
1/95	5.178									
1/96	5.125									
1/97	5.072									
1/98	5.020									
1/99	4.970									
1/100	4.920									
1/101	4.871									
1/102	4.824									
1/103	4.777									
1/104	4.731									
1/105	4.686									
1/106	4.642									
1/107	4.598									
1/108	4.556									
1/109	4.514									
1/110	4.473									
1/111	4.432									
1/112	4.393									
1/113	4.354									
1/114	4.316									
1/115	4.278									
1/116	4.241									
1/117	4.205									
1/118	4.169									
1/119	4.134									
1/120	4.100									
1/121	4.066									
1/122	4.033									
1/123	4.000									

Now that you have seen how close those harmonic lengths are to each other, it should be clear that we must have very accurate cycle lengths measurements indeed before we could have even the faintest idea as to whether or not there is more than chance correspondence.

E.R.D.

WHAT'S AHEAD FOR WHEAT PRICES?

In May I told you of a 9.3-year cycle in wheat prices. In the June—July report I told you of a 7.5-year cycle also present in these figures. I combined these two cycles and projected them into the future, making a forecast for you based upon this projection.

Now, in this report, I am refining the forecast by including in the synthesis and in the projection a third cycle in these figures, which turns out to be 4.7 years long.

There are other cycles in wheat prices also. To determine and evaluate them would doubtless increase the accuracy of the forecast. At a later time I shall make such a determination for you, but for the present I think the combination of these three cycles should serve your purposes.

The Four Elements in Wheat Prices

In our June—July report I discussed in detail the four elements that enter into wheat prices, viz: the significant cycles, the inflation factor, the trend, and the the random fluctuations. I shall not repeat that discussion. However, so that this article can more or less stand on its own feet, I shall repeat Fig. 1 which shows wheat prices for crop years beginning July 1. 1858—1952 in currency and in gold.

I am also repeating Fig. 2, adding however a diagram of the 4.7-year cycle and including it in the synthesis. In Fig. 2 I have also made a slight change in the trend, because now that we have the 4.7-

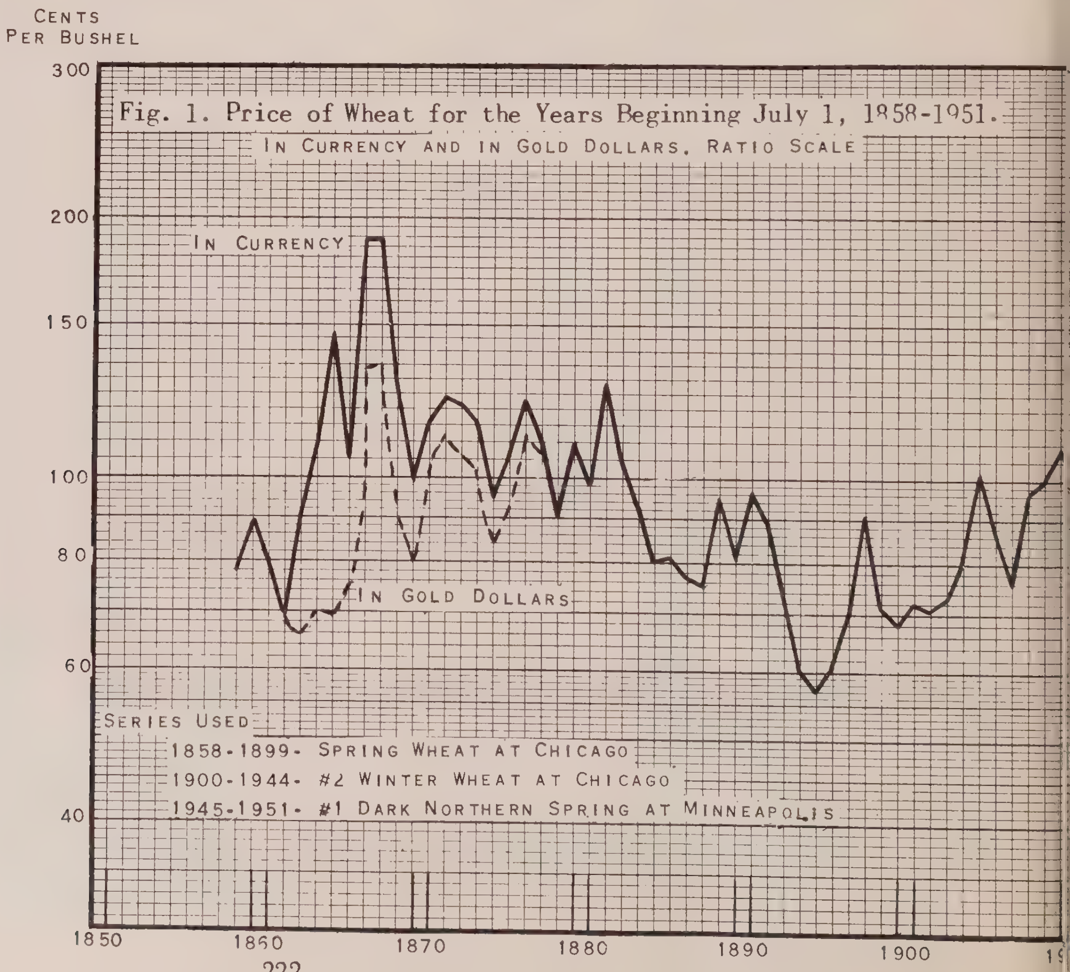
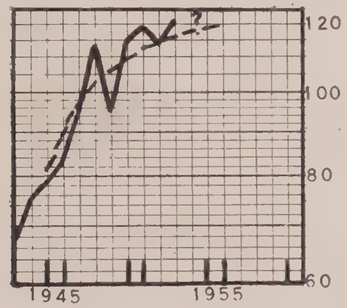


Fig. 1. Price of Wheat for the Years Beginning July 1, 1858-1951.
In Currency and in Gold Dollars, Ratio Scale

Series Used
1858-1899- Spring Wheat at Chicago
1900-1944- #2 Winter Wheat at Chicago
1945-1951- #1 Dark Northern Spring at Minneapolis

year cycle isolated, we can estimate trend a little more accurately, as shown by Fig. 3.

FIG. 3. WHEAT PRICES IN GOLD DOLLARS ADJUSTED FOR 9.3-YEAR, 7.5-YEAR, AND 4.7-YEAR CYCLES TOGETHER WITH TREND LINE.



In a new Fig. 4 I compare the price of wheat (in gold) with a synthesis of the three cycles and the trend and show the residual after adjustment for the three cycles and the trend. This residual shows the departure from the three-cycle pattern which has occurred in the past. Similar distortions will undoubtedly occur in the future.

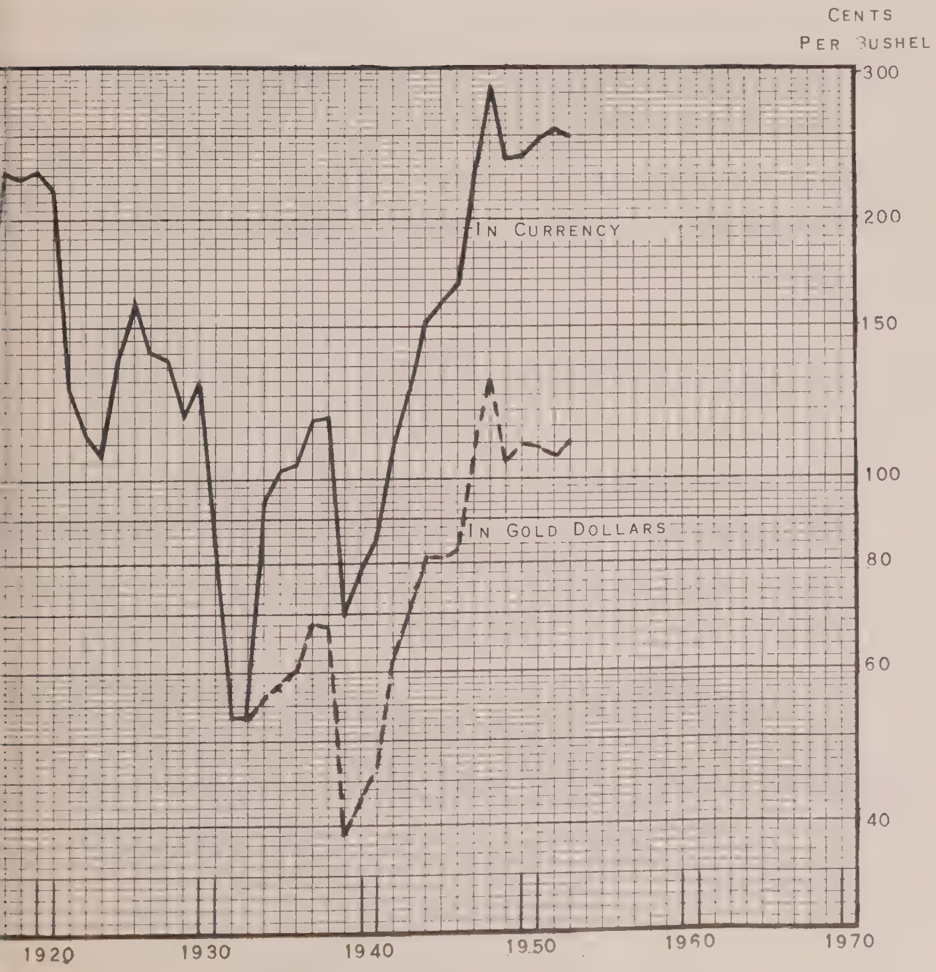
The 4.7-Year Cycle

The 4.7-year cycle crests ideally at January 1 1896 and every 4.7 years forward and backward from that time. This puts the last crest at May 1952, the next crest at January 1956, and of course the current low halfway between these two dates at September 1954.

The average overall amplitude of the 4.7-year cycle is 14.3%.

Comment:

Before discussing the future I would



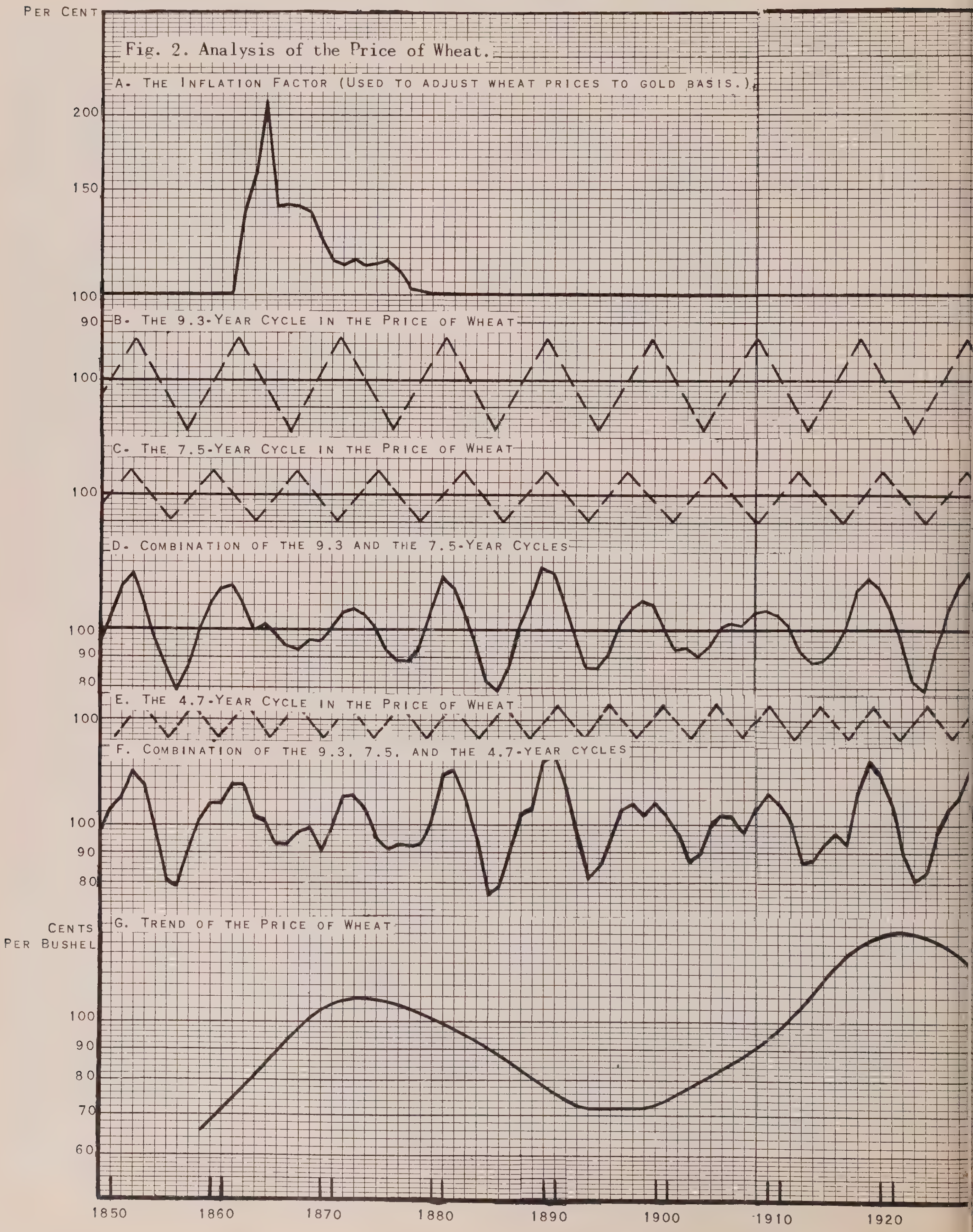


Fig. 2. Analysis of the Price of Wheat.

A. The Inflation Factor (Used to adjust wheat prices to gold basis.)

B. The 9.3-Year Cycle in the Price of Wheat

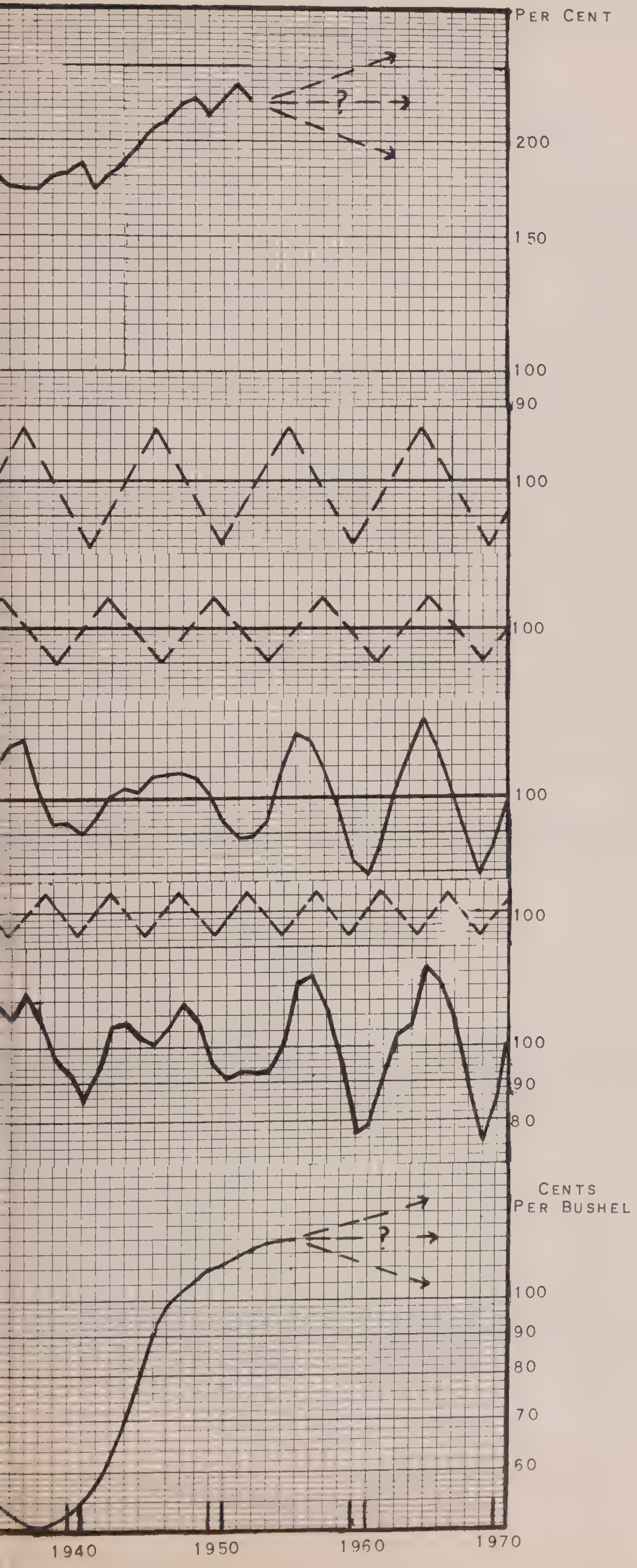
C. The 7.5-Year Cycle in the Price of Wheat

D. Combination of the 9.3 and the 7.5-Year Cycles

E. The 4.7-Year Cycle in the Price of Wheat

F. Combination of the 9.3, 7.5, and the 4.7-year cycles

G. Trend of the Price of Wheat



like to mention that supplemental research on wheat prices back to 1709 indicates that the 9.3-year cycle seems to be a compound of two cycles, one slightly longer than 9.3 years in length and one slightly shorter. This cycle therefore can be expected to fade out after a few more repetitions, and then to come in again in reverse phase (upside down).

The 7.5-year cycle also appears to be a compound cycle and may be expected to behave similarly.

These observations have no particular bearing upon the probable future behavior of wheat prices for the next twenty years or more, and are included merely for the sake of the record.

The Future:

The research in regard to the 4.7-year cycle tends to confirm, with but slight modification, the forecast made in the June—July report.

The downward effect of the 4.7-year cycle from the crop year 1952-53 to the crop year 1953-54 is just about equal to the slight rise in this period called for by the combined effect of the 9.3-year cycle and the 7.5-year cycle. Consequently, as far as the effect of the cycles is concerned, we should expect perhaps one more year of relatively stable wheat prices, in terms of gold.

Also, the effect of the 4.7-year cycle is to make the value of the composite cycle curve for the crop year 1956-57 slightly higher than the value for crop year 1955-56.

In other words, the inclusion of the 4.7-cycle in the projection does not change it significantly for the next few years. Thus we can continue to say that unless there is *drastic* deflation or a *drastic* change in the basic underlying trend of wheat prices, and if the cycles of the past continue, there is a very strong probability of an important upward movement, starting ideally from the crop year 1953-54 at about present levels, to a high due about 1956.

Following this crest, normal cyclic behavior calls for about four years of decline to a low in the general neighborhood of about 1960, to be followed by another important rise, 1960 to 1965.

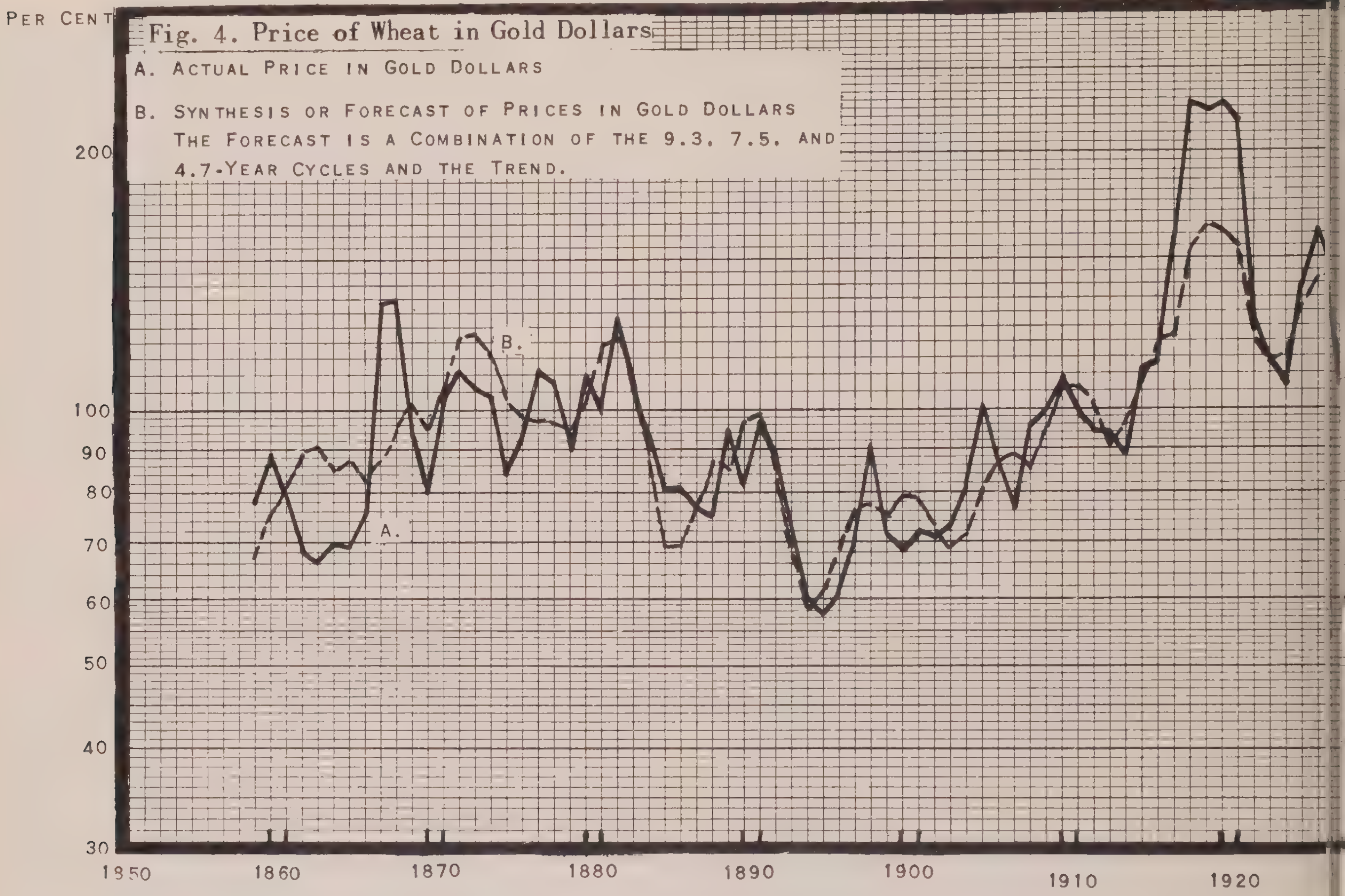
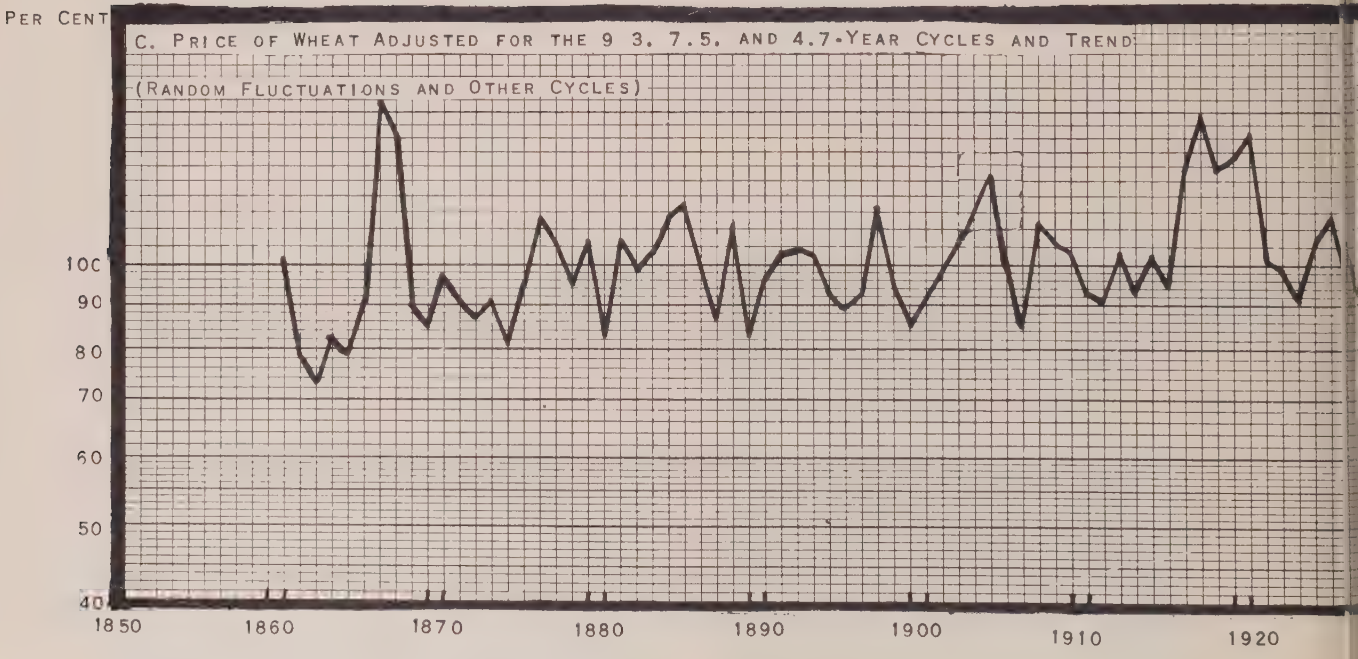
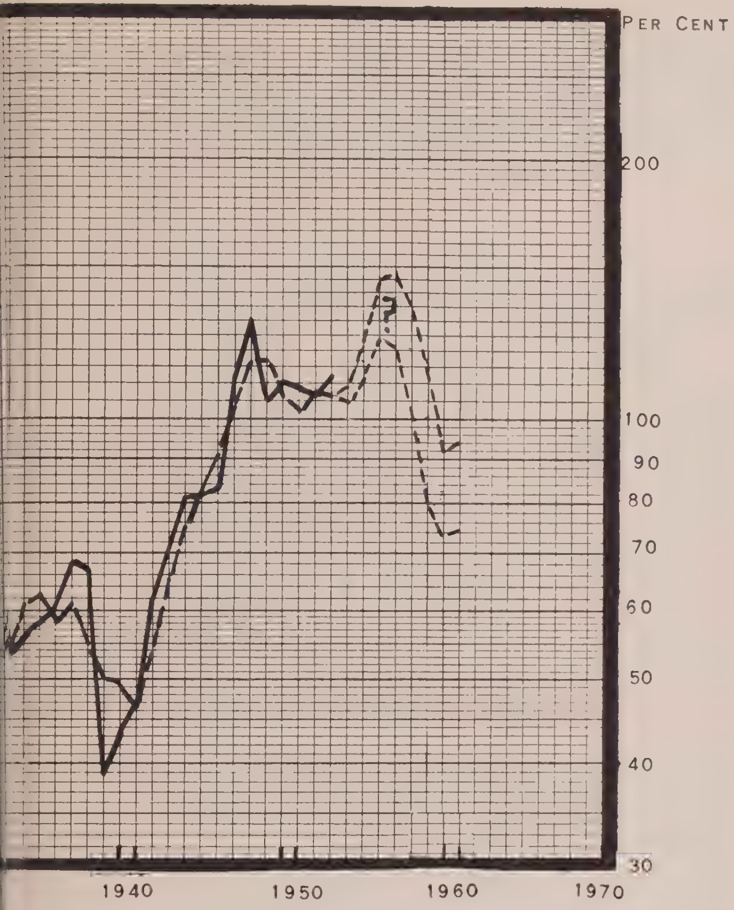
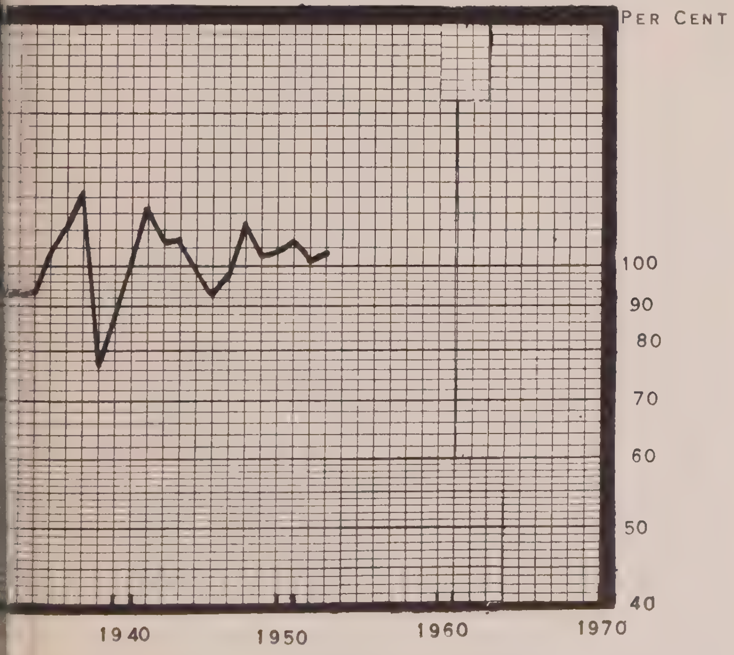


Fig. 4. Price of Wheat in Gold Dollars







From the charts you can easily see that the rise in price due to the composite effect of the three cycles named is in the neighborhood of 33%, and that the decline to follow is in the neighborhood of 47%. I state these figures with some reluctance because, even assuming the continuation of cycles, so large a part of actual prices depends upon the inflation factor, trend, random fluctuations, and other minor cycles. Random fluctuations and other minor cycles are illustrated by the lower curve in Fig. 4.

As I mentioned previously, the three factors, trend, inflation, and randoms are not cyclic and have to be determined separately. On the other hand, in the past, the cycles have pretty well prevailed, and it is my personal belief that in the absence of drastic governmental action in the future, they will continue to do so.

E.R.D.

THE 6.41-MONTH CYCLE IN STOCK PRICES

THERE is a 6.41-month cycle present on the average in industrial common stock prices (Standard and Poor's Corporation Index), 1871 to date. This cycle is also present on the average in the first 48 years, the middle 48 years, and the last 48 years. It cannot be seen clearly in sections less than 48 years long because of the seemingly concurrent presence of other cycles very close to 6.41 months long, also present in these figures.

I have told you repeatedly that, in my opinion, the way to use a knowledge of cycles to make money in the stock market is not to try to forecast the up and down moves of the market as a whole, or even of individual stocks, but rather to find a number of short cycles the combination of which you can play round trip on an actuarial basis. I promised to try to find a number of such cycles for you.

When you play on an actuarial basis you *expect* losses, just as the fire insurance company expects losses. Only, like the the insurance company, if the odds are in your favor, you will win in the long run.

In the end it will not matter whether the major moves are up or down, or change from one to the other. You will be operating on an *actuarial* basis, with a large number of gains and losses, but, hopefully, with more gains than losses and with larger gains than losses. Just like an insurance company, in the end, with enough transactions, you should come out all right--if the cycles are significant and have been correctly determined, and continue.

This 6.41-month cycle might be likened to the teaspoonful of salt called for by the cake recipe. It is needed in the cake all right, but if you take it by itself you are likely to choke. Therefore do not try to operate on this cycle alone. Wait at the very least until I have developed several more short term cycles for you, and combined them and projected them into the future. Even then you should watch the behavior of the projection for a while before you risk money on it.

As nearly as I can measure its length, the cycle upon which I am reporting in this article is 6.41 ± .005 months long.

As nearly as I can time this 6.41-month cycle it crests ideally in May of 1871 and every 6.41 months thereafter. This timing puts the current crest in August 1953, the next crest in March of 1954, and so on. The current low would be in November of 1953, the next low June of 1954, and so on.

Do not infer from the above statement that there will be a peak in August, a low in November, a peak in March of 54, a low in June and so on. Nothing of the sort. This cycle is much too weak to dominate. It shows itself only in *average* behavior when we take many repetitions of the cycle into account.

Speaking in terms of odds, if you go short in August, cover and go long in November, and sell in March (and if this cyclic behavior continues), the chances are 6 to 5 that you will make a profit on the round trip (and of course 5 to 6 that you will suffer a loss). If you make a profit and if it is of average proportions, your gain will amount to about 11.2%. If you make a loss, and if it is of average proportions the loss will amount to 7.7%. Combining these two sorts of probabilities we may say that, based on past behavior, the odds are 3 to 2 for gain on the round trip, and that the average gain (per round trip) will work out to about 3.5%. This of course amounts to about 7% a year.

Now no sensible person would try to operate on any scheme that promised so little, just as no sensible person would try to make a cake out of salt alone. But if you take enough ingredients you can make yourself a cake. This 6.41-month cycle is only the first ingredient. If, to it, we add a lot of other cycles we should get something very profitable indeed--provided of course that the cycles are significant, that they have been correctly determined, and that they continue.

E.R.D.

How it Came Out

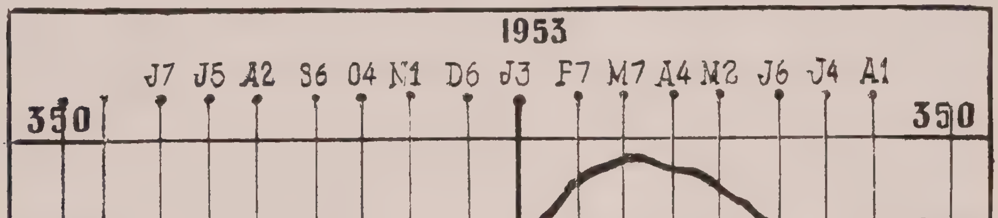
PREDIX INDUSTRIAL COMMON STOCK ANALYSIS

In our June report I printed a chart to show you how the Predix stock market cycle forecast, made in June 1952, came out in the 11 months which followed. The chart reproduced so badly that I am reprinting it in this issue, with additional values to bring it up to date.

The step curve shows actual Dow Jones weekly close from the date when the forecast was made up to July 31, 1953.

The heavy black line is the Predix forecast. The rise that materialized was no where nearly as great as called for by the forecast, but a purchase made the second week of June 1952, when the forecast was made and sold during the second week of March 1953, as called for by the projection, would have yielded a gain of 21 points for the 9 month period.

E.R.D.



Letters

A Letter from W. M. Douthit

Dear Mr. Dewey:

Will you please give us your opinion about the 18-year rhythm in real estate activity and building construction?

The lows for these rhythms were expected to be around 1953-54 (the trend of the rhythms being downward to that point), whereas we have been having a considerable boom in both for quite some time.

Do you believe the lows are yet to come, bearing in mind that "During the booms real estate goes to tremendous heights of activity and during the depressions it becomes frozen with relatively few voluntary transfers taking place", ,or do you think some powerful force (s) has intervened and that we are nearing the time for an upturn in this rhythm?

Sincerely yours,
W. M. Douthit

Los Angeles, California

In Reply I Said:

Dear Mr. Douthit:

It would be helpful to think of the 18-year rhythm in real estate activity and in building construction separately.

I am sending off this morning for recent figures in regard to real estate activity. Unless there has been unusual strength in this series recently, the peak of the curve of real estate activity printed in *Cycles—The Science of Prediction* reached its crest in 1945, only one year late from perfect timing.

Building construction, on the other hand, has behaved very differently. Everything proceeded normally until 1942, at which time the bottom fell out of building construction for three years. The years 1946, 1947, and 1948 were more or less normal but, as you know, there has been an upsurge since that time.

Whether this upsurge is making up for the building that was not done in 1944 and 1945 or is due to some other cause, I do not know.

We are at a time when, according to the 18 1/3-year cycle, building construction should be at a low. Unless you want to count the low of 1944 as a low come nine years early, the low of the present cycle is ahead of us and should manifest itself before the end of the decade.

Cordially yours,

A Letter from Massachusetts

Dear Mr. Dewey:

On page 178 of your monthly report "Cycles" for June—July 1953 there is a table referring to a 45 6/7-day cycle. I do not think that the time between May 9, 1953 and July 4, 1953 amounts to 45 6/7 days. Will you or Mr. Grand please explain the reason for the difference?

Cordially yours,
H. G. Olson

Babson's Reports
Wellesley Hills, Massachusetts

In Reply I Said:

Dear Mr. Olson:

The correct dates are given in the following table.

Ideal 45 6/7-Day Cycle in Mr. Grand's Stock

Day of Crest	Day of Trough
2-6-53	1-16-53
3-24-53	3-3-53
5-9-53	4-18-53
6-24-53	6-3-53
8-8-53	7-18-53
9-23-53	9-2-53
11-8-53	10-18-53
12-24-53	12-3-53

Thank you for calling this error to my attention. I'm sorry it happened.

Cordially yours,

Additions to the Library

"Behavior Cycles in Man and Animals" by Curt P. Richter. An abstract of a paper read at the annual (1953) Meeting of the National Academy of Sciences, reprinted from *Science*, May 1, 1953. Gift of Dr. and Mrs G. M. Stratton.

The abstract follows:

> For the study of behavior cycles in man we need daily observations and records of behavior over long periods of time. Psychiatric clinics offer the best opportunity for obtaining such observations and records.
>
> At the Phipps Psychiatric Clinic I have found records of patients who showed very regular cyclical changes in behavior, changes between normal and most abnormal behavior, between depression and elation, between stupor and excitement. The frequency of the cycles ranged from 2 to 40 days. For each patient the cycles had a definite frequency.
>
> Little or nothing is known about the origin of these behavior cycles in man. We have attempted to throw light on their origin through studies on the experimental production of cycles in animals.
>
> The rat lends itself best of all for such studies, since daily records can readily be made of its gross bodily activity (running in a revolving drum), food and water intake, body weight, and vaginal smears.
>
> We have produced regular behavior cycles by interfering with the endocrine glands: a 30–40-day cycle by thyroidectomy or by thyroid injury through treatment with I^{131} or sulfamerazine; a 20-day cycle by parathyroidectomy; a 14-day cycle by pituitary stalk section; a 90-day cycle by removal of one ovary and all except a small remnant of the other ovary.
>
> Cycles were produced in wild Norway rats by severe stress or by captivity.
>
> This knowledge may be of help in the understanding of the origin of behavior cycles in man.

• • •

"Cycles of Lynx Abundance," by Leonard W. Wing. *Journal of Cycle Research*, Volume 2, Number 2, Spring, 1953; 24 pages, 19 charts, 12 tables.

In this paper Dr. Wing shows that an index of Lynx (*Lynx canadensis*) abundance has a rhythm with wave length varying from about 6 to 11 years. When subjected to cycle analysis the index shows a dominant (alpha) cycle with an average length of 9.6 years and with an average amplitude of 257.0% of trend at its high and 38.9% of trend at its lows. The cycle indicated as probably the beta cycle has an average length of 35.2 years and average amplitude of 144.5% of trend at its highs and 69.2% of trend at its lows. A cycle designated as probably the gamma cycle has an average length of 22.2 years with an average amplitude of 138.0% of trend at its highs and 72.4% of trend at its lows. Five other cycles with average lengths of 7.46, 7.95, 9.0, 11.75, and 15.05 years are isolated and measured. The analysis indicates also the presence of a number of additional cycles.

• • •

"On the Reflection of Short-Term Fluctuations in Numbers in the Reproduction of Tetraonids," by Lauri Siivonen. Papers on Game Research, Number 9, Finnish Game Foundation, Helsinki, 1952, 53 pages, 3 figures, 9 tables, references. Gift of the author.

Dr. Siivonen is the Director of the Game Research Institute of the Finnish Game Foundation, and is Professor of Zoology at the University of Helsinki. He is the person to whom the Foundation for the Study of Cycles awarded its Summer 1953 Fellowship.

In this paper, using data from 1906, Dr. Siivonen studied the short-term fluctuations in the number of numerous mammalian and bird species in Finland and Norway. For the majority of the species studied, the cycles average 3 1/3 years.

Foundation Affairs

MEMBERSHIP DISTRIBUTION

I have just made a geographical breakdown of our membership. I think it will interest you as much as it interested me.

On May 1, 1953, we had 2,143 members. Of these, 2,062 lived in Continental United States and 81 elsewhere.

The detailed geographical distribution of these two groups is as follows:

CONTINENTAL UNITED STATES

BY STATES, AND BY CITIES WITH EIGHT OR MORE MEMBERS.

ALABAMA	16
ARIZONA	17
Phoenix	9
ARKANSAS	12
CALIFORNIA	221
Oakland	16
Los Angeles	54
San Francisco	20
COLORADO	30
Denver	15
CONNECTICUT	63
Greenwich	8
DELAWARE	13
Wilmington	10
FLORIDA	69
Miami	9
GEORGIA	19
IDAHO	6
ILLINOIS	171
Chicago	109
INDIANA	36
IOWA	23
KANSAS	11
KENTUCKY	11
LOUISIANA	17
New Orleans	9
MAINE	3
MARYLAND	38
Baltimore	21
MASSACHUSETTS	116
Boston	33
MICHIGAN	80
Detroit	33
MINNESOTA	29
Minneapolis	16
MISSISSIPPI	7
MISSOURI	59
Kansas City	18
St. Louis	28
MONTANA	5
NEBRASKA	8
NEVADA	5
NEW HAMPSHIRE	14
NEW JERSEY	91
NEW MEXICO	6
NEW YORK	382
Rochester	16
New York City	217
NORTH CAROLINA	17
NORTH DAKOTA	3
OHIO	86
Cincinnati	19
Cleveland	20
OKLAHOMA	20
OREGON	7
PENNSYLVANIA	113
Philadelphia	26
Pittsburgh	13
RHODE ISLAND	19
Providence	12
SOUTH CAROLINA	14
SOUTH DAKOTA	7
TENNESSEE	9
TEXAS	53
Houston	10
UTAH	2
VERMONT	5
VIRGINIA	25
WASHINGTON	25
Seattle	15
WEST VIRGINIA	8
WISCONSIN	23
Milwaukee	11
WYOMING	3
UNALLOCATED	7

OUTSIDE CONTINENTAL UNITED STATES

CANADA	49
Montreal	12
Toronto	15

Other Countries Include: AUSTRALIA, COLOMBIA, CUBA, DOMINICAN REPUBLIC FRANCE, HAWAII, HOLLAND, INDIA, JAPAN, MEXICO, NEW ZEALAND, INDONESIA, WEST INDIES, PUERTO RICO, SWEDEN, SWITZERLAND, SOUTH AFRICA, TURKEY.

THE 1953 SUMMER FELLOWSHIP

The 1953 Summer Fellowship was awarded to Dr. Lauri Siivonen, Professor of Zoology at the University of Helsinki and Managing Director of the Game Research Institute of the Finnish Game Foundation.

Dr. Siivonen is now in residence at Foundation research headquarters, studying the techniques of cycle analysis.

He plans to return to Finland in the early part of September. *E.R.D.*

EXCERPTS FROM

CYCLES

THE SCIENCE OF PREDICTION

(CHAPTERS III AND IV and APPENDIX I)

by EDWARD R. DEWEY
Director, Foundation for the Study of Cycles

and EDWIN F. DAKIN
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TOGETHER WITH 1953 SUPPLEMENT

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III

The Growth Trend in Our Basic Industries

To draw the trend lines that Pearl uses in such population charts as were reproduced in the foregoing pages, we need to deal with equations, of which the smooth curve is the graph.* Such a method is too complicated for the average businessman who wants to explore trends. It is not only that he may lack the training in mathematics. Even more important, he will probably not recognize the fact that he is dealing with a logistic curve when he puts figures down on a chart.

A man who charted the growth of his infant son in pounds, every week from the day the boy was born, would ordinarily know that the rapidly rising line would eventually level out. (He can get weight charts that will tell him just when the " bend-over " in the line is due.) But when he charts his corporate sales he seldom realizes — as he sees the line go steeply up — that something like a logistic curve is being worked out here, too, and that the line will eventually bend over suddenly. Further, when it does eventually bend, he will usually regard this as a temporary slump that will be remedied by a resumption of progress in due course.

It is possible to avoid the dangers leading from such fallacious judgments by charting figures on semilogarithmic, or ratio, scale. That is, instead of using the Pearl type of graph, we can use a ratio scale, then get a curve which, by its changing shape, automatically reveals the falling off in the rate of growth. With such a scale the elongated italic ∫ of Pearl usually becomes a smooth elongated italic parenthesis (.

Let us turn back for a moment to the Pearl chart showing the population growth of the United States, on page 15. Now if we stood at 1920 on this chart, and no dotted line indicating the future were there to warn us, we might well assume that the upward sweep of the line would continue indefinitely. We might assume this, at least, if our knowledge were limited to that of the average American, and if our emotions were geared to the prevailing American sentiment that progress has always existed in this nation and therefore always must — if not at the same rate as in the past, then at a still better one. Only specialized knowledge and training could warn us that this chart (as of 1920) could not justify such expectation.

Fig. 1 on the next page is a chart of our population's growth on ratio, not arithmetic, scale. Standing at 1920 on *this* chart, we could have looked back and have been readily aware that we were almost at the top of a long slope that was already slowly leveling out. The steady decline in the *rate* of growth at this point is clearly evident, and the approximate point at which growth will peter out entirely is clearly indicated by the nature of this simple curve itself. Taking our place on this curve at 1920, we could have projected it into today without vast margin of error, even if we had merely worked freehand with a pencil. This kind of chart, which shows us the rate of growth at a quick glance, is preferable for our purposes on many grounds. (SEE ALSO APPENDIX 1 AT THE END OF THIS EXCERPT.)

Pearl has taught us something very valuable — that a *law* of growth exists, and that it operates consistently. In using hereafter a form of chart somewhat different from Pearl's, the authors are merely charting the operation of that law in a manner they believe the average reader will find more readily useful and applicable to his immediate problems.

It is in this form that the growth of America's basic industries will be graphed. The reader who then wishes to apply the method to his own business may easily come up with a comparable chart. All he need do is to chart his own figures on a similar grid. He can then know immediately where his business stands, in comparison with other broader national developments, without having recourse to any special mathematical knowledge.

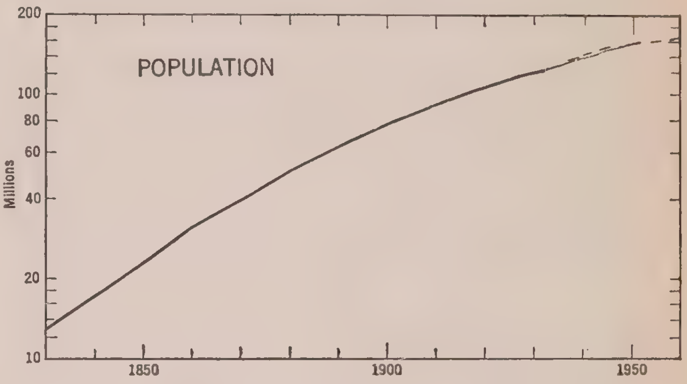

Fig. 1. Population of Continental U. S., 1830–1940
Decennial data. A trend is shown, projected tentatively to 1960. *Ratio scale.* (For a full explanation of ratio scale, see Appendix I.)

The charts shown in connection with this chapter are rather striking in the uniformity of the story they tell. Consider first our total manufactures, which are shown in Fig. 2 in terms of their growth since 1830, in dollars compensated for changing purchasing power.* The rate of growth of our manufactures has been steadily

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* Thus the equation of the logistic curve for France which Pearl employed was

$$y = 6.604 + \frac{35.975}{1 + 0.808e^{-0.0197x}}$$

* All dollar charts in this chapter and the one next following are so compensated. That is, the values for each year have been divided by the index of the average wholesale prices for that year, 1926 being considered as unity.

declining since around 1900. By 1920, as can be seen from the chart, it had become a fraction of the rate prevailing in the late 1800's. In at least one sense we may completely ignore the peak established during World War II. Notice that it reaches far above the trend line, and surpasses all other peaks attained previously.

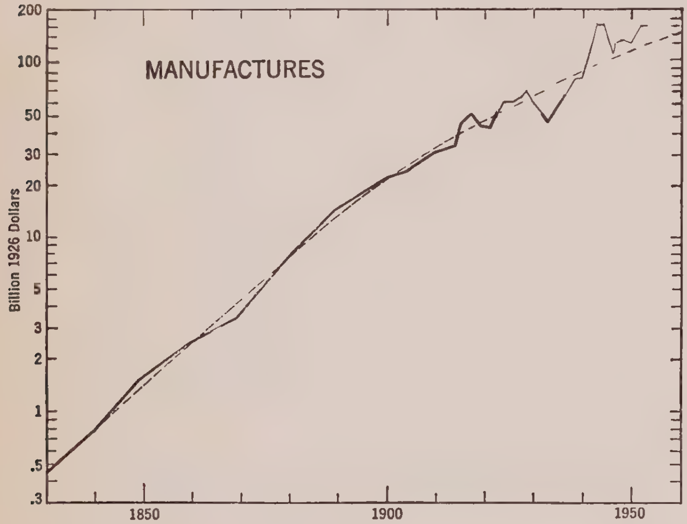

FIG. 2. U. S. MANUFACTURES, 1830–1952

Data decennial 1830–1899; quinquennial 1899–1919 with estimates for war years; biennial 1919–1939; annual estimates thereafter. The data have been adjusted for the purchasing power of the dollar, 1926 = 100.

A trend is shown projected tentatively to 1960. The war years, as the text explains, have been ignored in determining trend in this and in all other charts portraying growth. *Ratio scale.*

Unfortunately — for the purposes of our society — it represents production for purposes of destruction. Being a wartime phenomenon, it tells us nothing beyond the fact that under the centralized compulsion of a war economy we had an enormous capacity to produce.

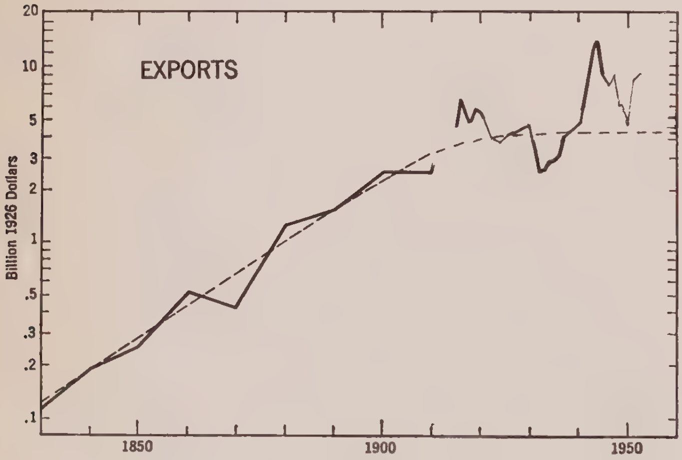

FIG. 3. U. S. MERCHANDISE EXPORTS 1830–1952

Data decennial 1830–1910; annual 1910–1952. Data are adjusted for the purchasing power of the dollar, 1926 = 100. A trend is shown projected tentatively to 1960. *Ratio scale.*

The underlying trend line tells us much more. What that line says is this: Under the economic system prevailing before the war — to which we are presumably returning — we were closely approaching the upper limit of our ability to *produce and distribute within the frame of that system.* Following its wartime peak, our volume of manufactures is bound to fall back toward the trend line, and perhaps well below it, before again stabilizing itself around the trend. Rather than a matter for philosophical argument, this assumption seems supported by the evidence of the pattern that has been established in our economy since the very beginnings of our nation — a pattern that can be approximately determined and, consequently, approximately projected.

When we compare the chart for manufactures with the charts that show rate of growth in our exports and imports (see Figs. 3 and 4), we meet a consistency that we should now be prepared to expect. Both exports and imports are measured here in dollars that are compensated for varying purchasing power, like the value of manufactured goods charted previously. Let us look first at Fig. 3, showing exports. The basic pattern established by the trend is undeniable, and it tells us something for the future. The export levels we established during World War II, by giving away almost unlimited volumes of goods via lend-lease, mean nothing — *except that we did give these huge volumes of material away.* In peacetime, our export volume should tend to return toward the true trend line — and perhaps sink below it for a while — unless we continue giving goods away in much the same fashion. Or unless a new trend is to be established, one we cannot now calculate.

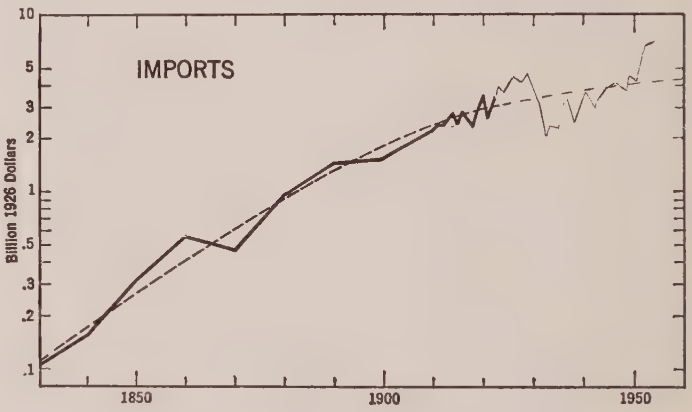

FIG. 4. U. S. MERCHANDISE IMPORTS, 1830–1952

Data decennial 1830–1910; annual 1910–1952. Data are adjusted for the purchasing power of the dollar, 1926 = 100. A trend is shown, projected tentatively to 1960. *Ratio scale.*

Devices like the Bretton Woods Economic agreement, or Treasury grants made as political " loans " to foreign nations, may tend for temporary periods to mask this truism — much as the working of the Federal Reserve Act tends to conceal from the general public the fact that we print dollars to meet government deficits. But our chart says forthrightly, in statistical language, that on the basis of the long-established trend, and in terms of foreign trade handled at a real profit, we should not be too optimistic in looking for such trade to be increased over the prewar volume.

In other words, the pattern here shows what we have seen in other charts: We are approaching an upper limit of action, within the frame of our economy as it has long existed. If we now continue giving our goods away as in World War II — either as goods or in the form of uncollectible loans exchangeable for our goods — then of course we might presumably maintain any chosen volume of exports. But that method of exporting, if used in peacetime trade over any long period of time, will itself be a kind of revolution. All our chart can tell us is that, failing a revolution of some sort, the pattern as established will presumably prevail.

Merchandise imports, similarly charted for rate of growth in compensated dollars, tell us much the same story. Here we can see that (barring the period of World War II) the peak was reached in the decade that followed 1920. There seems no evidence to suggest that in our time, or in the frame of our economy as we know it, the peak of the twenties will ever be importantly exceeded. Certainly in a world where economic facilities outside the United States have been so extensively wrecked, and where the United States itself has an unprecedented volume of production facilities of its own, we hardly need a chart to tell us that levels of useful imports in the future will certainly not exceed, for any considerable period, those already established in the past. Not, that is, within the frame of familiar economic relationships.

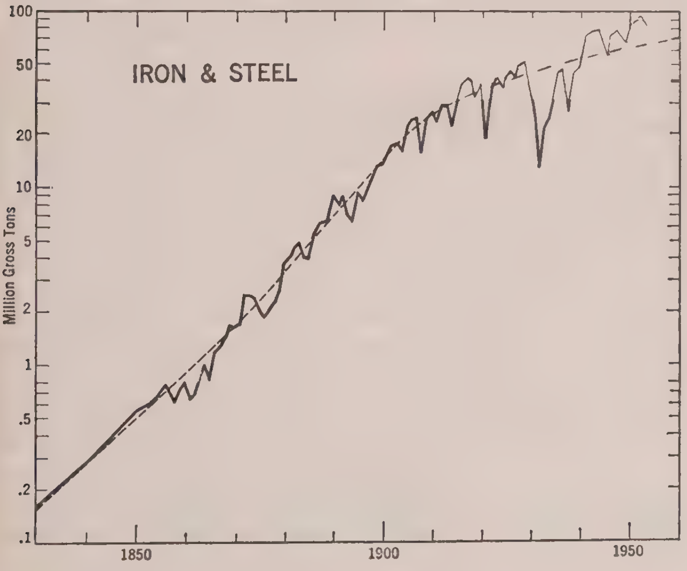

FIG. 5. U. S. IRON AND STEEL PRODUCTION

Shown in gross tons of 2240 lbs. each. Pig iron production 1830–1913 (decennial 1830–1850, annual 1854–1913). Steel ingot production 1914–1952. A trend is shown, projected tentatively to 1960. *Ratio scale.*

1953 POSTSCRIPT: GROWTH CURVES USUALLY BEND OVER CONTINUOUSLY WHEN PLOTTED ON RATIO SCALE, AS IN FIG. 1, FIG. 6, AND MANY OF THE OTHER CHARTS SHOWN.

THE RELATIVELY UNIFORM RATE OF GROWTH OF IRON AND STEEL PRODUCTION FROM 1830 TO 1910 MAY HAVE BEEN DUE TO THE CONCURRENT PRESENCE OF A 54-YEAR CYCLE CRESTING ABOUT 1910, TROUGHING IN THE EARLY 1930'S, AND NOW REACHING TOWARD A CREST IN THE 1960'S; BUT MORE ABOUT CYCLES LATER.

E. R. D.

Probably no industry so accurately mirrors progress in our industrialized economy — and, in turn, is mirrored in that progress — as does our iron and steel industry. Iron and steel are truly basic products in the machine age that has been with us for the last century and a quarter. They are tools in almost every "civilized" activity. That is why iron and steel production reflects both the physical and the psychological drives of a nation like the United States.

Fortunately for statistical purposes, the records for iron and steel production go back further, and are more nearly exact, than those for most of the other great American industries. By using pig iron production before 1913, and measuring steel output by steel ingot production after that date, we can trace the history of the industry's activity back almost to its beginning.

The steel industry has been an old industry since 1914. Note the curve showing its growth, in Fig. 5. The relapse it had around 1914 was normal in extent, as compared to all previous depressions that followed peaks in activity. But the next depression that came along, following World War I, carried steel production to lower levels than were reached in the 1914 relapse. The depression of the early thirties carried it to still lower levels. Such a series of sinking spells, each more serious than the last, would indicate in a human organism a slowly declining vitality. In the steel industry we may see, over a long period, a slowly declining rate of profit, and a rapid decline in the rate of growth.

The peak in steel production that occurred during World War II may be ignored, for purposes of significance in a creative and solvent economy. That fantastic peak did not represent creative construction to serve the purpose of man as an economic creature, but rather represented an explosion like that of aerial bombs which destroy themselves when they reach their target.

Steel production in whatever peace we enjoy hereafter promises ultimately to return to somewhere around the trend levels already established in the long history of the steel industry; it may even sink temporarily well below these levels — once it has supplied whatever pent-up needs consumers feel as they emerge from the war years, and assuming we avoid both armament races and gifts of free steel to other nations.

Many of our other great industries have also reached their maturity. Note, in Fig. 6, the chart for the growth of steam railroads (miles of road operated). The maximum was reached between 1910 and 1914; since then there has been an actual decline. The railroad industry as such will have no more real expansion under economic conditions as we know them. Just as significant as the maturity reached in mileage operated is the fact that the tons of freight *originated* have actually shown a decline on the per capita of population basis, even during the years of World War II.

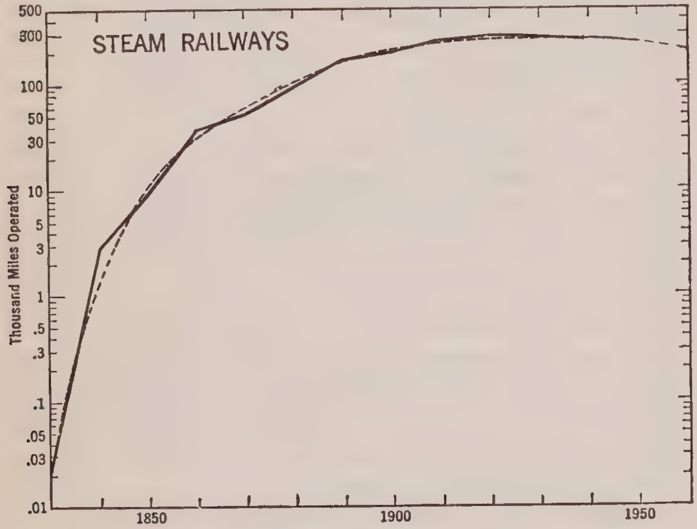

Fig. 6. Steam Railways

Miles of road operated (first track) in continental United States, 1830–1950: Decennial data. A trend is shown, projected tentatively to 1960. *Ratio scale.*

Much was made of the unprecedented volume of freight traffic carried by the railroads in the recent wartime period, and of the record of freight-miles built up. Such figures largely reflect long hauls and the fact that the usual unit of measurement is the ton-mile. But by 1943, when our war effort was in full swing, total tonnage originated was still only about 9 per cent more than it had been in 1929. On the per capita basis it was actually less, because the population had increased. General Leonard P. Ayres of the Cleveland Trust Company, one of the country's foremost statisticians, could only call it "astonishing" that our railroads in 1943 actually originated less freight per capita of the population than they did in most of the years from 1911 through 1929, and far less than in the war years of 1917–1918.

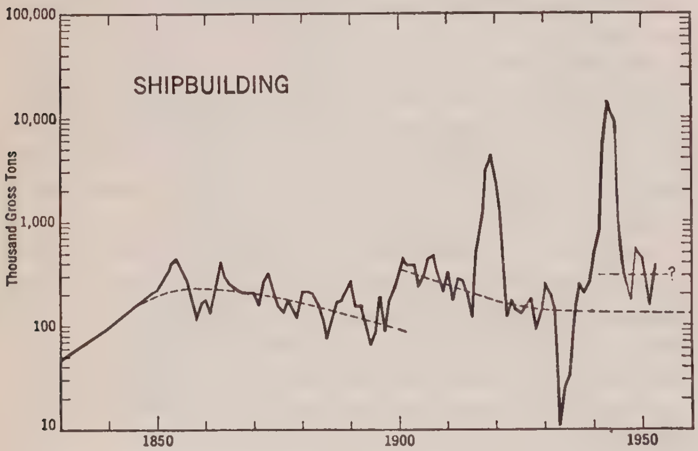

Fig. 7. U. S. Shipbuilding, 1830–1952

For 1894–1939 the gross tonnage is shown of merchant vessels launched (100 tons or over). Prior to 1894 the chart shows tonnage of vessels built, adjusted to conform to the average tonnage launched from 1894–1907 and set back one year. From 1939–1952 the gross tonnage is shown of merchant vessels built (1000 tons or over).

Two trends are indicated, the present one projected to 1960. *Ratio scale.*

The shipbuilding industry, which reached fantastic peaks of construction under the war impact, will doubtless go right back to the levels it came from (see Fig. 7). Even continued subsidies to operators can hardly save it from such deflation; these existed, thanks to the Merchant Marine Act, long before the war began. There is nothing in the long-time growth pattern of the shipping industry to suggest that continued subsidies, of whatever probable volume, will change the pattern to any appreciable degree. World War I raised shipbuilding twentyfold — from about 200,000 to about 4 million gross tons a year. Thereafter the trend prevailing since around 1907, when a decline had set in, was resumed. This peacetime trend will probably be resumed once more as the axis around which yearly shipbuilding volume will fluctuate.

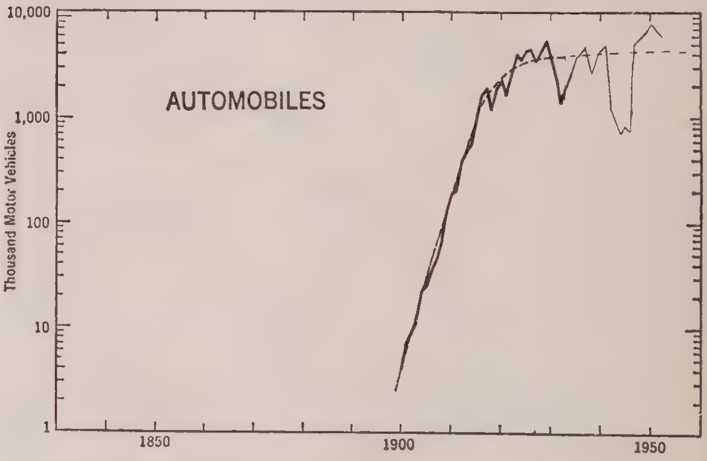

Fig. 8. U. S. Automobile Production, 1900–1952

Factory sales of motor vehicles, with a trend projected tentatively to 1960. *Ratio scale.*

The automobile industry in early 1946 had a huge volume of new orders, but there was no evidence that these would create a new trend line. The industry's rate of growth was declining sharply well before 1940, and was closely approaching maturity, as shown in Fig. 8. Whatever temporary postwar splurge the industry may enjoy, the trends revealed in the chart suggested it had already attained, prewar, the bulk of the mature maximum of output. A *Fortune* estimate of mid-1944, for instance, concluded that a production of 4½ million cars annually from mid-1945 on would completely saturate the market by 1950; a production of 6½ million cars would saturate it by the end of 1947. Actually, of course, all early forecasts of automobile production for the months immediately following the war were vitiated by the occurrence of a strike wave; even 1946 production fell much below the manufacturers' earlier hopes. While failure to produce more cars in 1946 came from inability to manufacture, and not from the lack of a market, subsequent years should be watched for an answer to an apposite question: Will even "deferred demand," so called, enable the automobile industry hereafter to get very far above its prewar average production levels?

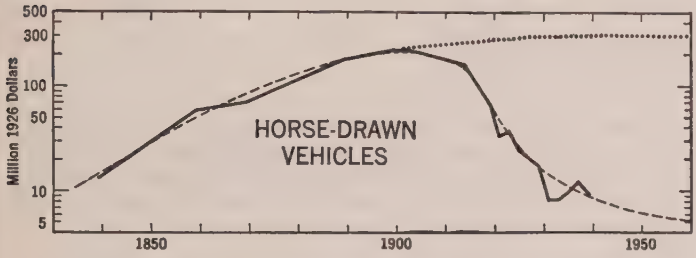

Fig. 9. Value of U. S. Horse-Drawn Vehicle Production, 1839–1939

Data decennial 1839–1899, quinquennial 1899–1919, biennial thereafter. Data are adjusted for the purchasing power of the dollar, 1926=100. A trend is shown, projected in dashes tentatively to 1960. *Ratio scale.*

We have here an example of an industry which, even before reaching maturity, was superseded by another. Without the advent of the dynamic automobile industry, which destroyed it, the horse-drawn vehicle industry would doubtless have reached maturity at the levels indicated by the dotted line at the top.

What happened to the earlier carriage industry is shown in Fig. 9.

Grouped together on pages 36–41 the reader will find charts showing the trend in a number of basic activities as various as cattle on farms, corn production, cotton production, wool production, wheat production, malt liquor consumption, lumber production, cotton spindles in operation, coal production, copper production, and lead production. These are shown not because any one of the series charted is particularly significant in itself, but because as a group the charts tell a consistent story, and — most important — because long series of figures are available.

They indicate that maturity has been or is being reached throughout our economic fabric as a whole. In the light of such charts, any talk of the unlimited frontiers that lie before us is a pure expression of faith and hope. The statistical evidence does not support it. Like goldfish nibbling at the glass of their bowl, we have demonstrably been reaching the circumference of our economic *world-as-it-is.*

This is not a tragic fact; it is merely a fact. We may adjust ourselves to it well or badly. Still more, we may decide as a society that we refuse to live in a world of such an established circumference, and try to break whatever bonds have been holding us there (if we can discover what they are, of what they are made, and how to break them), and then create a world with far wider horizons for ourselves. Some may suspect that this course will be the one that Americans will ultimately try to follow.

There are some newer industries in the nation which still have much of their growth ahead of them. We shall survey a few of these briefly in the following chapter. They should be of interest to investors who are concerned with the long-term outlook, and to young people who are intelligently choosing industrial careers.

There is no reason, however, to assume that the activity of any one of them, or of all of them put together, will change the near-term national outlook suggested by the charts discussed in this chapter.

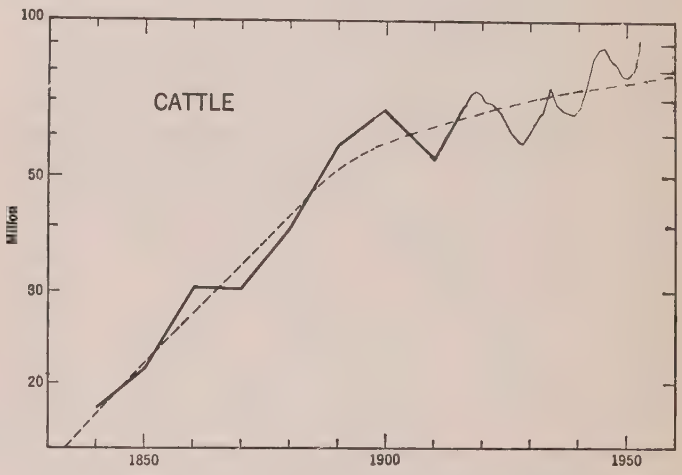

Fig. 10. Cattle on U. S. Farms, January 1840–1952

Data decennial 1840–1910, annual thereafter. A trend is shown, projected tentatively to 1960. *Ratio scale.*

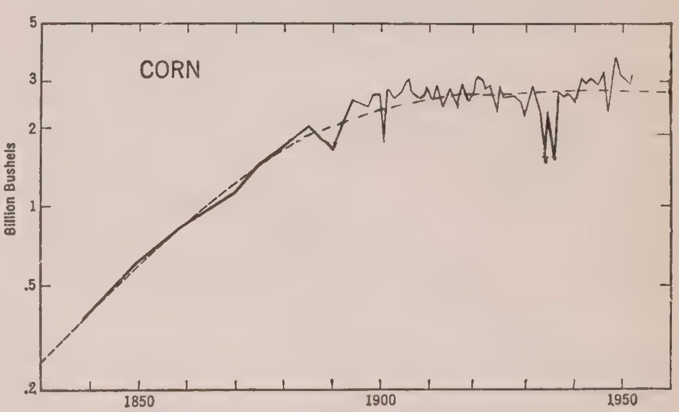

Fig. 11. U. S. Corn Production, 1839–1952

Data decennial 1839–1870, quinquennial 1870–1895, annual 1898–1952. A trend is shown, projected tentatively to 1960. *Ratio scale.*

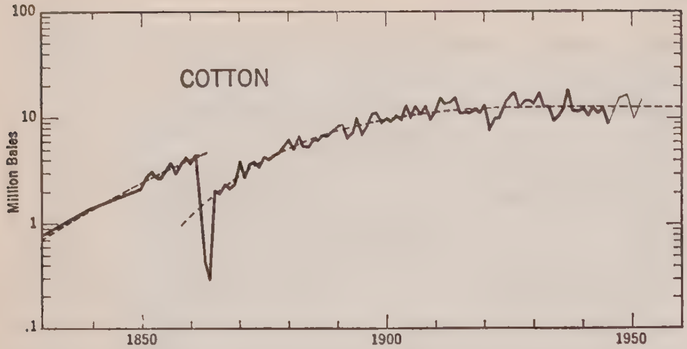

Fig. 12. U. S. Cotton Production, 1830–1951

Data decennial 1830–1850, annual thereafter. Two distinct trends are shown, one prior to and the other following the Civil War. The latter has been projected tentatively to 1960. *Ratio scale.*

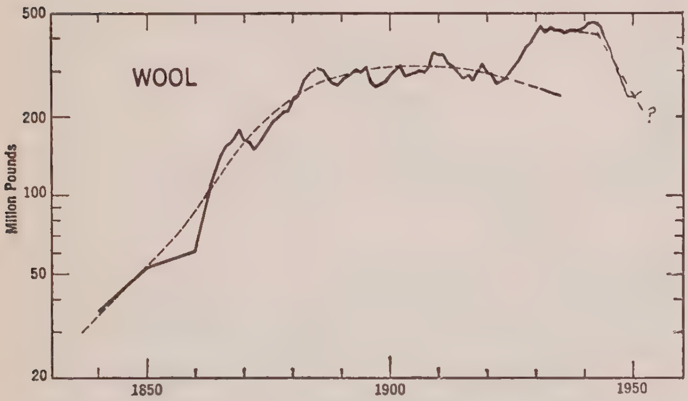

Fig. 13. U. S. Wool Production, 1840–1951

Data decennial 1840–1860, annual thereafter. Two distinct trends are shown, one prior to and one following the Tariff Act of 1924. The latter has been projected tentatively to 1960. *Ratio scale.*

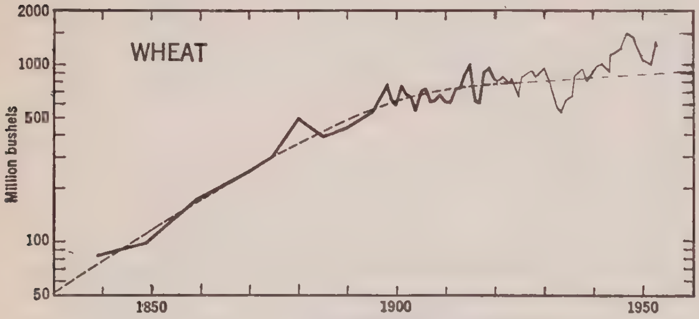

Fig. 14. U. S. Wheat Production, 1839–1952

Data decennial 1839–1870, quinquennial 1870–1895, annual 1898–1952. A trend is shown, projected tentatively to 1960. *Ratio scale.*

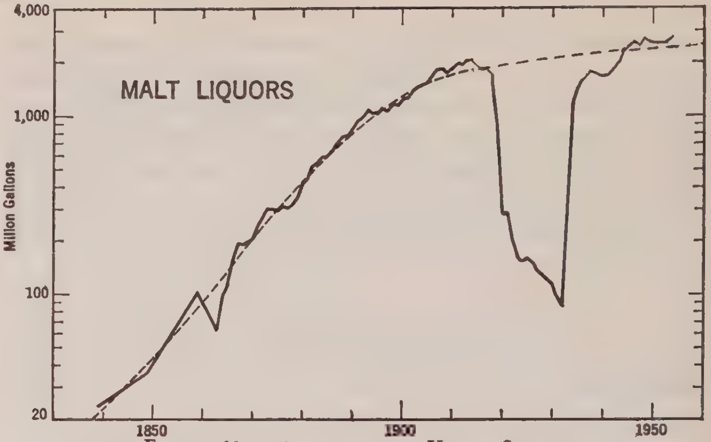

Fig. 15. Malt Liquor in the United States

Consumption 1839–1920. Production 1921–1952 Data decennial 1839–1859, annual 1863–1952. The effect of prohibition is clearly indicated. A trend is shown, projected tentatively to 1960. *Ratio scale.*

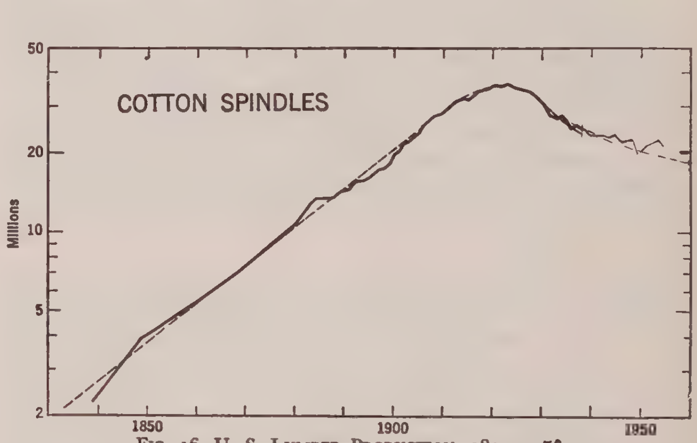

Fig. 16. U. S. Lumber Production, 1839–1952

Data decennial 1839–1899 (1849 missing), annual 1904–1952. First two points are estimated from value data. A trend is shown, projected tentatively to 1960. *Ratio scale.*

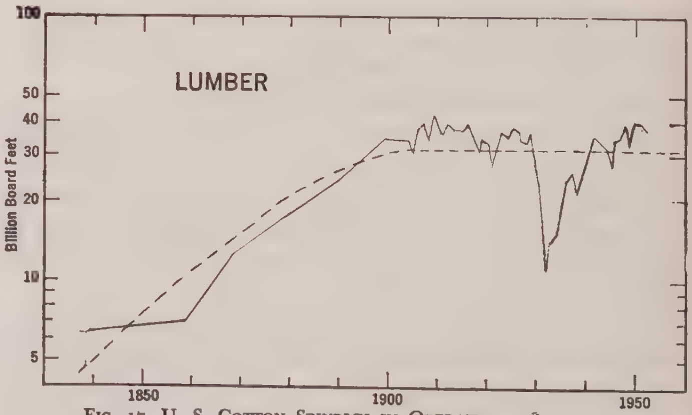

Fig. 17. U. S. Cotton Spindles in Operation, 1839–1952

Data decennial 1839–1880, annual 1880–1952 A trend is shown, projected tentatively to 1960. *Ratio scale.*

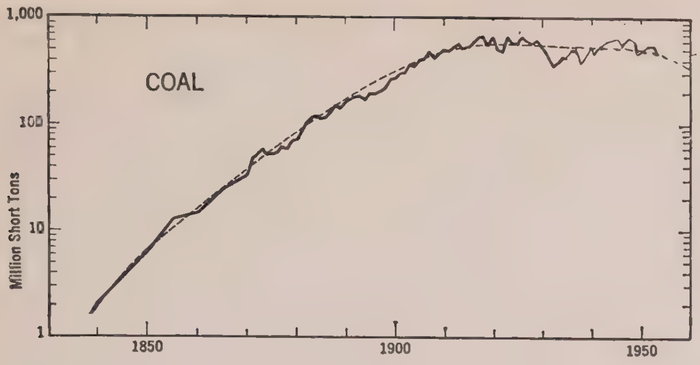

Fig. 18. U. S. Coal Production, 1840–1952

Data decennial 1840–1850, quinquennial 1850–1870, annual thereafter. A trend is shown, projected tentatively to 1960. *Ratio scale.*

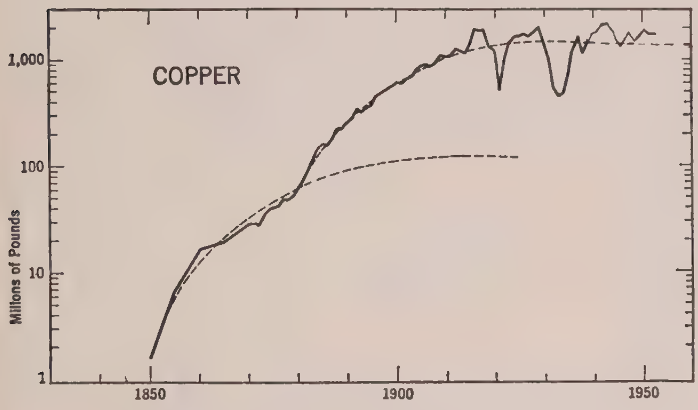

Fig. 19. U. S. Smelter Copper Production, 1850–1952.

Data quinquennial 1850–1870, annual thereafter. A new cycle of growth, coinciding with the birth of the electrical industry, began in 1880. Two trends are shown, the present trend projected tentatively to 1960. *Ratio scale.*

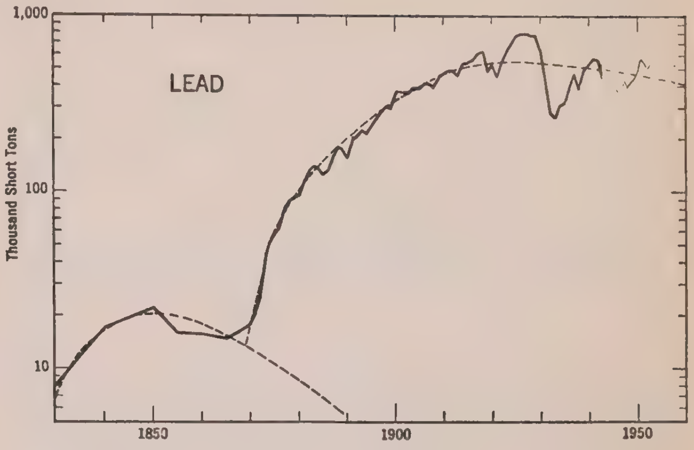

Fig. 20. U. S. Refined Primary Lead Production, 1830–1952

Data decennial 1830–1850, quinquennial 1850–1870, annual thereafter. Here again two cycles of growth are in evidence. The beginning of the second cycle coincides with the junction of the Union Pacific and Central Pacific tracks at Utah in 1869, when western lead ores were made available to market. Two trends are shown, the present trend projected tentatively to 1960. *Ratio scale.*

IV

Trends in Some Other Industries

During the thirties, when panaceas were sought on every hand for the then prevailing depression, hopes were expressed time and again that a new industry would spring up to absorb the unemployment slack. " Something like automobiles " was the comparison frequently heard. No industry capable of fulfilling the expressed hope appeared. Nor does it seem probable that one will appear on today's postwar scene with enough drive to take up whatever slack in employment may develop in the late forties or early fifties.

It is true that we have a number of relatively new industries. It is equally true that a number of them hold promise of great national service, and eventual large expansion. But from what we know of trends, we are now able to understand that industries follow an orderly pattern of growth, just as do all other organisms. They do not spring full-blown upon the world. Any great industry that can function to create impressive employment in the immediate postwar years is with us right now. It is already on the scene, with an established rate of growth subject to our examination. Furthermore, while these industries offer interesting careers, they are forging ahead with methods that usually produce more material with less human effort than do the processes of older competitors.

What about the various chemical industries, for instance? These are a group of industries hailed as the probable savior of the nation's future, a new frontier that will indefinitely extend the nation's progress to ever higher standards of living. Figure 1 provides an answer for one such industry — rayon. Rayon may be viewed as perhaps typical of the young chemical industries. Ignore its wartime distortions, and observe the basic trend. It has a gratifying and interesting course of growth lying ahead of it. Its owners will doubtless make money. But it seems doubtful if they will create any phenomenal amount of extra employment. The fact is that practically none of our chemical industries makes for a volume of direct employment as compared to industries of analogous dollar sales volumes founded in an older era. There are technological reasons involved.

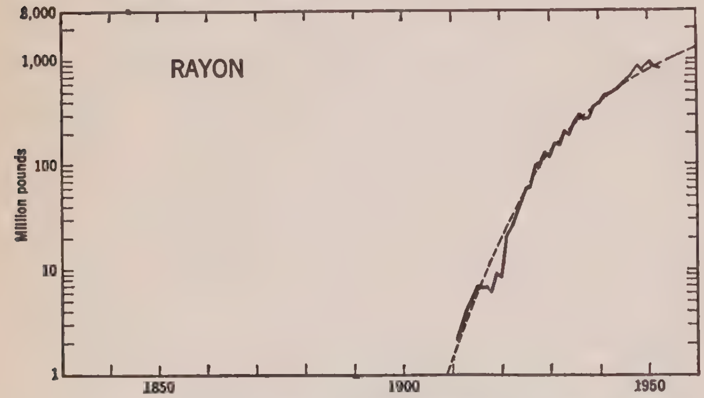

Fig. 1. U. S. Rayon Yarn Consumption, 1911–1952
A trend is shown, projected tentatively to 1960. *Ratio scale.*

Suppose we consider aircraft. Aircraft was a baby industry before the war; war gave it the status of a munitions industry, and airplanes were turned out as flying platforms for bombs, in numbers limited only by our capacity to build and fly them. To appraise the prospects of the aircraft industry in postwar days we need only glance at the trend line in Fig. 2. Allow for a 100 per cent margin of error on the side of underestimate, and we would still have to conclude that following the war the aviation industry would revert to very youthful dimensions. That is just what began happening in late 1945. The two million people it was able to employ in wartime were reduced to a tenth (or less) of their number by the middle of 1946, for the purposes of building peacetime planes.

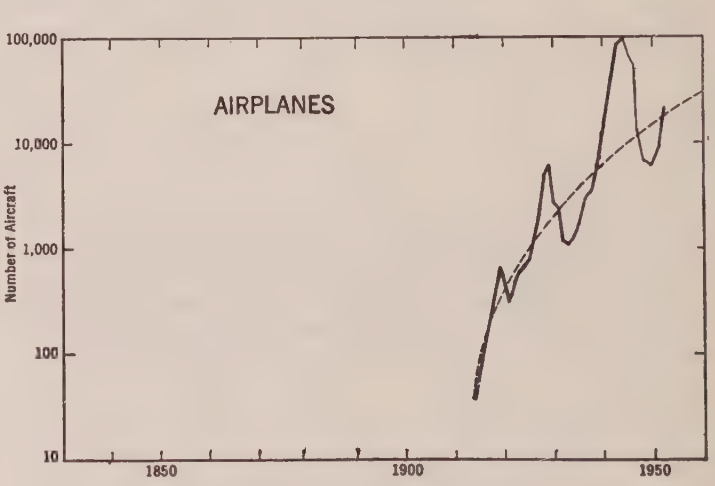

Fig. 2. U. S. Aircraft Production, 1914–1952
A trend is shown, projected tentatively to 1960. *Ratio scale.*

Charts showing the trend lines for some of our other younger industries suggest a similarly orderly growth — allowing for due cyclic interruptions of the kind we shall later discuss.

Some industries, like radio manufacturing and electrical refrigeration, are not so young in point of trend as some might suppose. They were already slowing markedly in their rate of growth before the war; replacements had become even then an important factor in maintaining volume; and, after a postwar spurt, the volume of sales will probably not be sufficient to break established growth patterns.

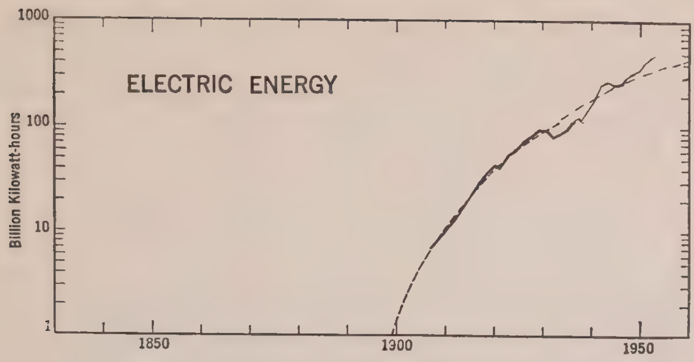

Fig. 3. U. S. Electric Energy Production, 1907–1952

Data for 1907, 1912, 1917, 1919; annual thereafter. A trend is shown, projected tentatively to 1960. *Ratio scale.*

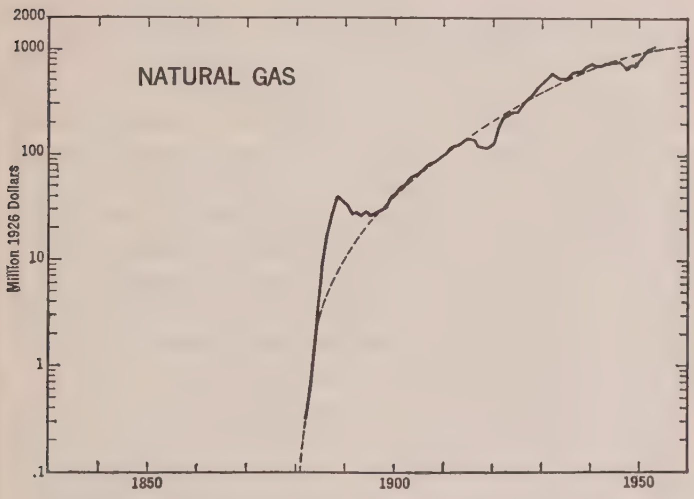

Fig. 4. Value of U. S. Natural Gas Production, 1882–1952

Data are adjusted for the purchasing power of the dollar, 1926 = 100. A trend is shown, projected tentatively to 1960. *Ratio scale.*

On the other hand, natural expansion still lies ahead in the production of electric energy, natural gas, petroleum, and paper and wood pulp. And industries like electronics and certain branches of chemicals are still almost in their infancy.

The chart on page 49 is adopted from an idea originally proposed by Roger Babson, to indicate only suggestively — and not with any degree of measured accuracy — the relative positions of a large number of our industries, in terms of their comparable age, or present rate of growth.

It provides occasion to reiterate that organisms differ greatly in the time they require for reaching maturity. There may be as much variation between two industries, or two corporations in the same industry, in the time span they require for growing from infancy to maturity, as there is between different kinds of animals and different populations.

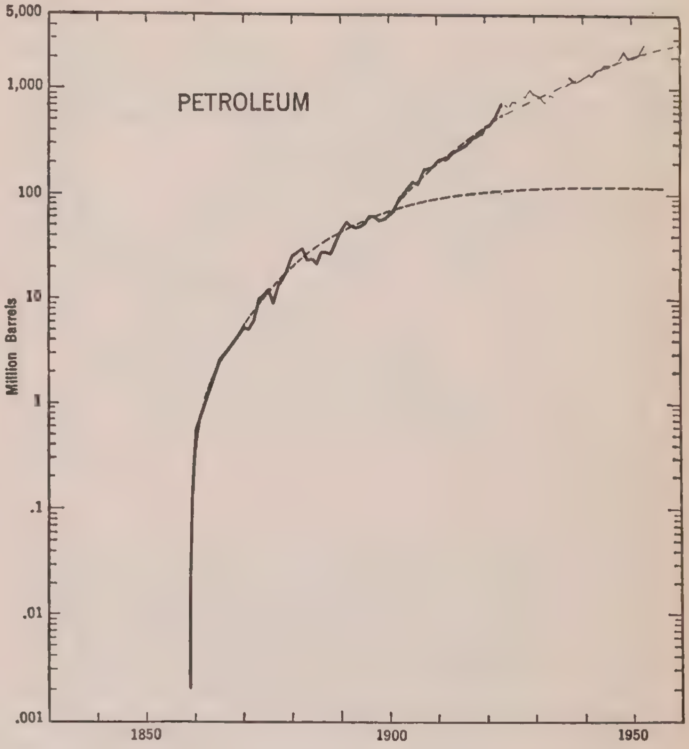

Fig. 5. U. S. Petroleum Production, 1859–1952

Data for 1859, 1860, 1865, 1870; annual thereafter. Two trends are shown, the present one projected tentatively to 1960. *Ratio scale.* What we really have here is first the illuminating-oil industry upon which was superimposed the motor-fuel industry.

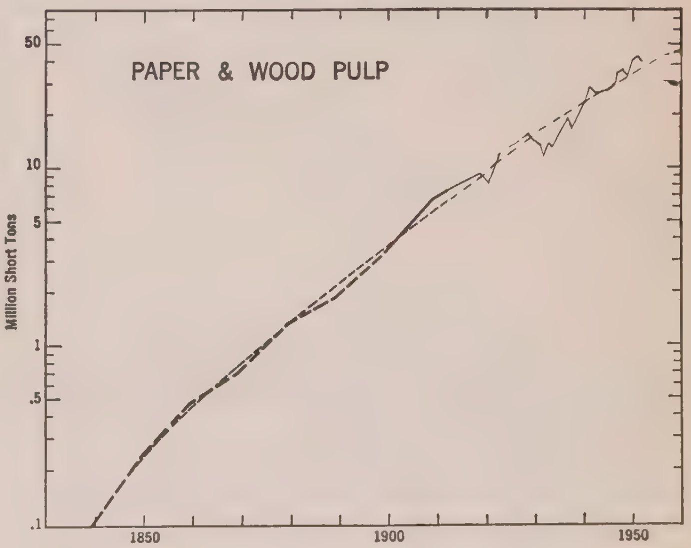

Fig. 6. U. S. Paper and Wood Pulp Production, 1839–1952

Data decennial 1839–1900, quinquennial 1909–1919, biennial 1919–1929, annual thereafter. Data for 1839–1899 estimated from value figures. A trend is shown, projected tentatively to 1960. *Ratio scale.*

The younger industries shown on this composite chart have, in the rapid rate of growth that characterizes youth, a resiliency that may allow them to face the downsweep of postwar cycles with greater aplomb than some of the industries that have reached maturity — for reasons indicated in Chapter I.

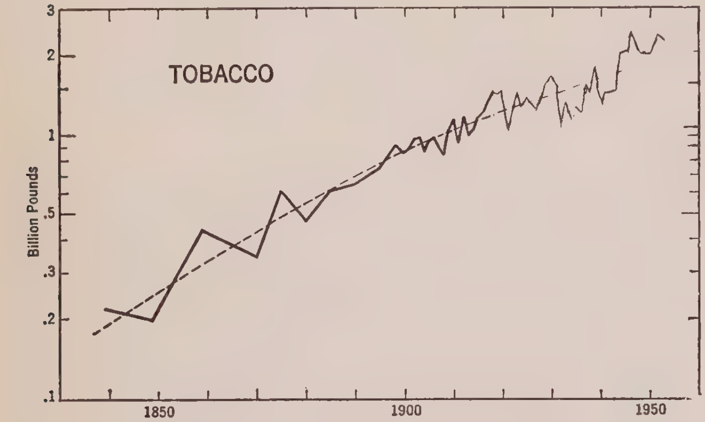

Fig. 7. U. S. Tobacco Production, 1839–1952

Data decennial 1839–1870, quinquennial 1870–1895; annual 1898–1952 A trend is shown, projected tentatively to 1960. *Ratio scale.*

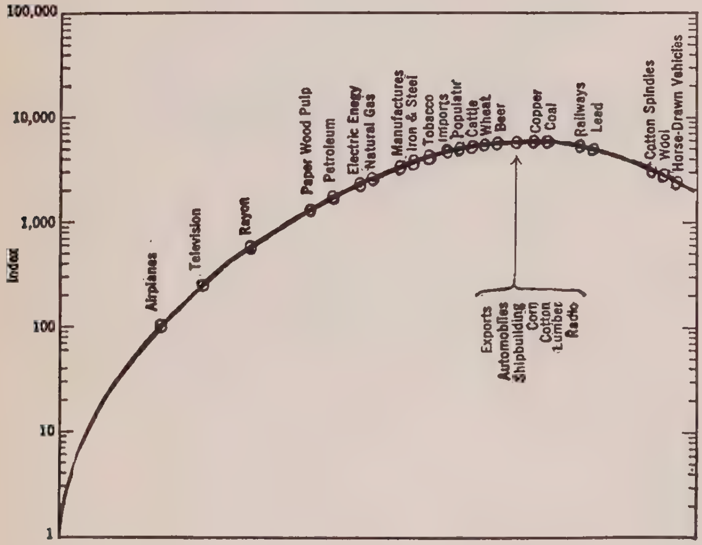

Fig. 8. Trends of Various U. S. Industries

Diagrammatic representation of a growth curve on which there have been located with only approximate accuracy, various American industries, according to their present rate of growth. *Ratio scale.*

When an industry is young and growing fast, it appears here at the left, where the curve is rising rapidly. As it gets older and more mature, it is located near the top of the curve, or even beyond. (Chart after an idea by Roger Babson.)

On the other hand, many mature industries, like steel, have managed to build up large financial reserves to carry through lean days, on a scale which young industries have not managed to emulate. Building of comparable reserves has been difficult for today's younger industries like aircraft, which have had their first taste of prosperity in a period of heavy wartime taxation.

1953 POSTSCRIPT TO CHAPTERS III AND IV

As I reread Chapters III and IV (and Appendix I) I see but few changes to make except in the charts which have, in all instances, been brought up to date as nearly as possible.

The seven additional years of figures confirm the original thesis that our country, in common with all other things that grow, is growing at a less rapid rate than formerly. E. R. D.

Now that we have dealt with trends, we are ready to inquire into the cycles that accompany trends.

To distinguish accurately a trend as it is manifested in the life of the nation's industry, or business, we must first know the cycles.

Suppose, for instance, that a corporation is enjoying a period of relatively high sales volume, compared to its experience of five years previous. Is this volume the result of its normal rate of growth — a growth proceeding at a relatively rapid rate, because the corporation is young? Or is it rather the result of an upsweep that is cyclic — a temporary gain that will be heavily compensated for later? To what extent may the rise be both? So far as the rise is cyclic, when must we be prepared to face a decline? In so far as it is a trend, may it be expected more or less to continue?

A knowledge of prevailing trends provides us with the first key required for answering such questions — questions that may be applied alike to a whole economy or to an individual corporation. When we know what the cycle is, we are then in a position to isolate its effect from that of the trend, and study trends as separate entities. Studies of the trend without prior study of the cycle must therefore be purely tentative.

We shall quickly discover that the so-called business or economic cycle is in reality a composite of many different cycles. We shall be particularly interested in studying them for evidences of *rhythm.* For if and when we find rhythm we can, *to the extent justifiable,* predict recurrence; and we shall have predictability on the basis of much more than finite logic and guess.

It has long been assumed that if we could only isolate the *causes* of economic cycles we could then effectually prevent them, and so eliminate the downsweeps that plague highly organized societies.

Many volumes have been written to discuss the causes. Here we shall be far less concerned with the cause than with the *timing.* Like the weatherman, we are concerned initially not with altering the weather, but with the problem of predicting it with fair accuracy, so that those due to be out in it can be properly prepared.

APPENDIX I

The Ratio Scale

THE SOLID LINE in Fig. 1, on page 3, shows the sales of a hypothetical business that grew 90 per cent in the five-year period from 1905 to 1910, 80 per cent in the next five-year period, 70 per cent in the next, and so on. The rate of growth, that is, declines 10 per cent in each five-year period, and falls to a level of 20 per cent in the five-year period from 1940 to 1945.

The curve in Fig. 1 gives little or no *visual* warning of the drastic fall-off in sales that lies immediately ahead (as shown by the broken line in this chart) if the growth pattern continues in the future as in the past. If this pattern does continue, the sales in 1950 will be only 10 per cent more than the sales in 1945, and the sales in 1955 will show no growth whatever when compared to 1950.

In order to make this situation visually clear, many businessmen and students of trends prefer to plot all data pertaining to growth on what is known as a *ratio* (or *semi-logarithmic*) *scale.* On such a scale equal vertical distances represent equal *percentage* change.

Let us illustrate by charting the growth of another business using both the arithmetic and ratio scales.

The business starts at a sales volume of $2,000 a year; the second year it doubles its sales to $4,000; the next year it doubles again to $8,000.

On the arithmetic scale these facts would be represented in a chart laid out as follows:

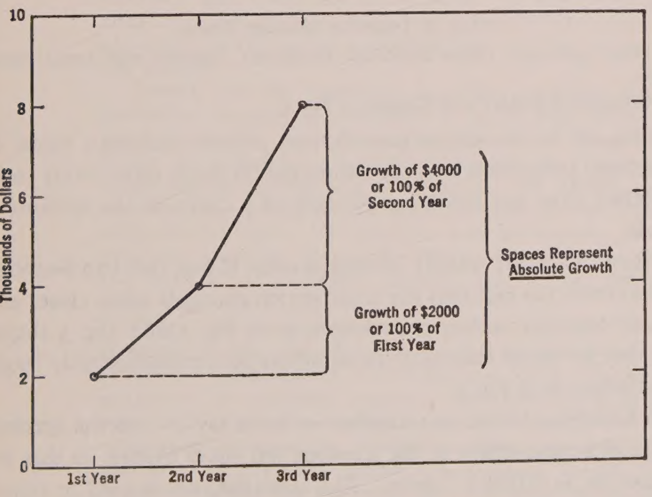

FIG. 1. EQUAL RATE OF GROWTH — ARITHMETIC SCALE

Sales of a hypothetical business organization showing constant *rate* of growth. *Arithmetic scale.*

On a ratio scale, the same facts would be represented on a chart laid out in this fashion:

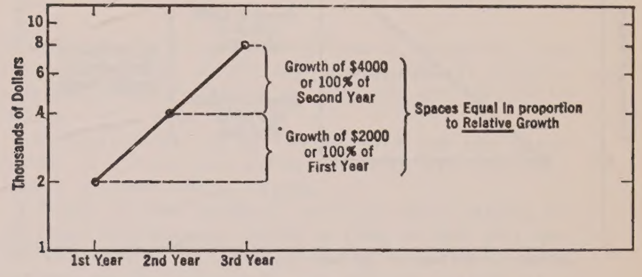

FIG. 2. EQUAL RATE OF GROWTH — RATIO SCALE

Sales of a hypothetical business organization showing constant *rate* of growth. *Ratio scale.*

Notice that on a ratio scale the numbers on the vertical scale represent equidistant percentage values, and come closer and closer together, in a way that interposes the same vertical distance between 4 and 8 as between 2 and 4 (because 8 bears the same relation to 4 that 4 bears to 2).

A straight line plotted on a ratio scale means that the *rate* of growth is constant. (Such a state of affairs, of course, never exists for long in any real situation.)

When the *rate* of growth declines as the business or the organism gets older, this decline is represented on a ratio scale by a bending-over in the line.

Thus, if the business cited here grew from $2,000 in its first year to $4,000 in its second year, and then grew an equal *amount* — from $4,000 to $6,000 — from its second to third year, these facts would be shown on *ratio* scale as follows:

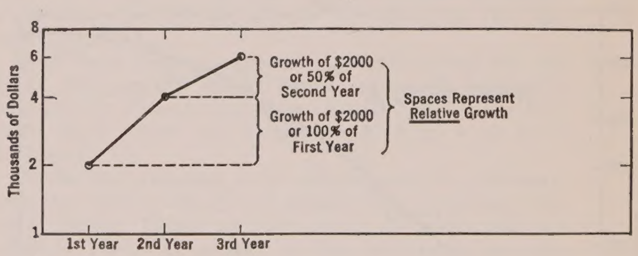

FIG. 3. EQUAL AMOUNT OF GROWTH — RATIO SCALE

Sales of a hypothetical business organization showing constant *amount* of growth. *Ratio scale.*

On the other hand, using the arithmetic scale, the line would continue from the second to the third year at the same slope as from the first year to the second, giving no visual suggestion that the rate of growth was declining. The same figures plotted on the arithmetic scale would look like this:

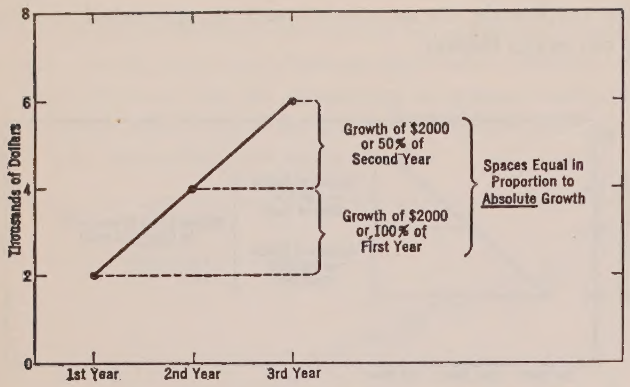

Fig. 4. Equal Amounts of Growth — Arithmetic Scale

Sales of a hypothetical business organization showing constant *amount* of growth. *Arithmetic scale.*

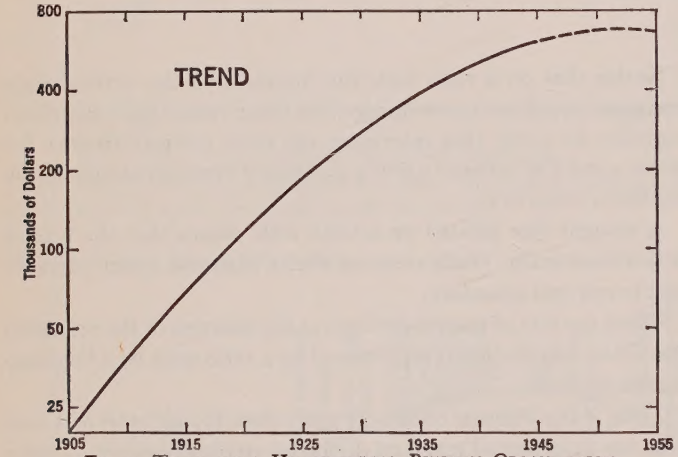

Fig. 5. Trend of a Hypothetical Business Organization

Data 1905–1945, with a projection to 1955. The projection is based on the assumption of a continuation in the constant decline of the rate of growth, as discussed in Chapter 1. *Ratio scale.*

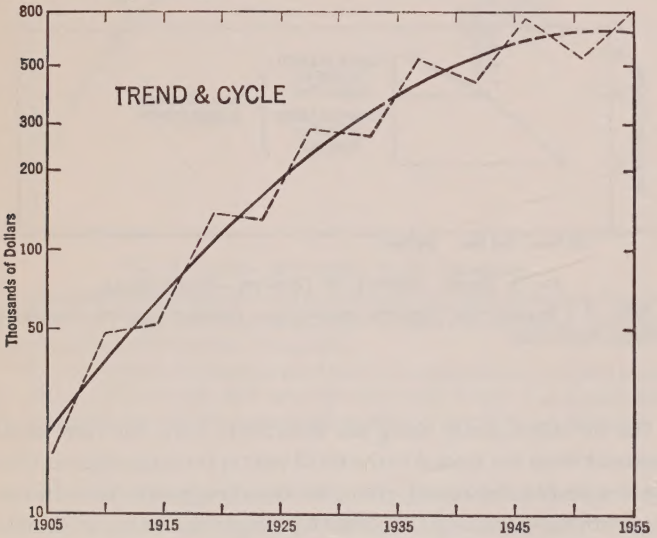

Fig. 6. The Trend and the Cycle

Trend of a hypothetical business organization, as shown in Fig. 5, with a regular cycle of 20 per cent amplitude superimposed. *Ratio scale.* Note that when one uses ratio scale, the wave has equal absolute magnitude throughout.

Further to compare the difference between arithmetic and ratio scales, the sales of the hypothetical business discussed in Chapter 1 are plotted on a ratio scale in Fig. 5.

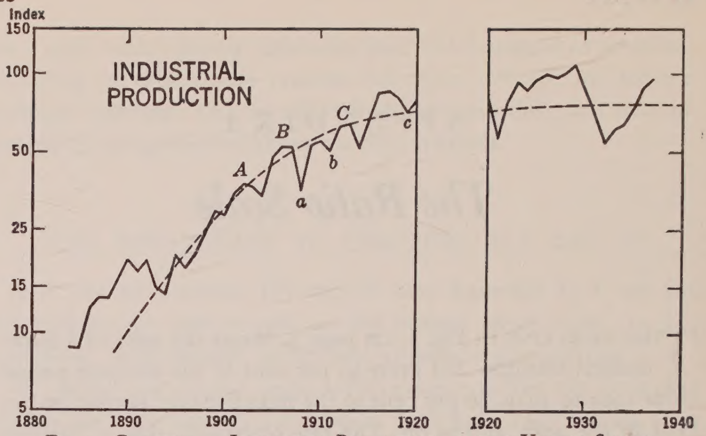

Fig. 7. Growth of Industrial Production in the United States

Data 1884–1937, together with trend. (After Davis.) The chart has been split into two parts to emphasize the changing character of the trend. *Ratio scale.*

On ratio scale all booms and depressions are shown in their true relative proportions.

Compare this chart with Chapter 1, Fig. 3.

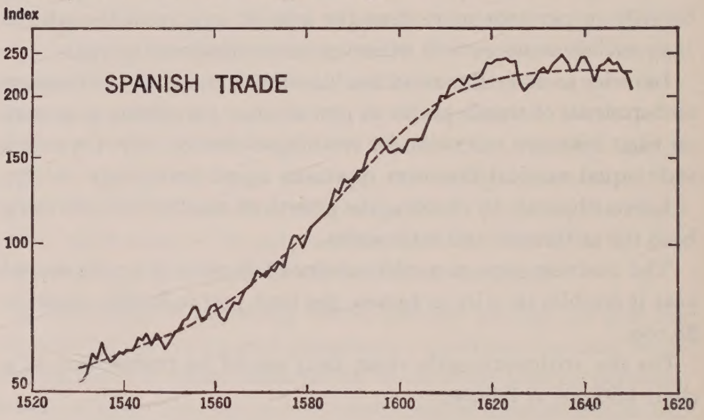

Fig. 8. Index of Spanish Trade

Data 1530–1650, (After Davis and Hamilton), together with trend. *Ratio scale.*

Compare this chart with Chapter 1, Fig. 4.

One advantage of such a plotting is that it shows directly the falling off in the rate of growth, and permits making a visual or freehand projection into the future that is much more likely to be fulfilled than any similar projecting of a chart on the arithmetic scale.

Ratio scales are usually labeled as such. If not, they can be recognized from the fact that the numbers on the scale come closer and closer together as they grow larger, as in Fig. 2 and Fig. 3 above; or else, for equal intervals, the numbers get proportionately larger and larger, as in Fig. 5.

The interval from one number — let us say 1 — on the vertical scale of a ratio chart to the number ten times higher, in this instance 10, is called a "cycle." The same distance is used to represent the next tenfold growth, from 10 to 100, and so on. In reading a curve plotted on ratio scale, one should always look at the vertical scale to see how many cycles are involved.

So that the reader may make additional comparisons of data charted on ratio and on arithmetic scales, the data of the rest of the charts in Chapter 1 have been plotted on ratio scales, and are given in Figs. 6, 7, and 8.

All the charts in Chapters III and IV and many of the charts in the rest of the book are plotted on ratio scale.

GLOSSARY

Cycle, coming from a Greek word meaning circle, implies coming around to the place of beginning. Strictly speaking, in the word itself there is no necessary implication of regularity, but the word is often used loosely to denote rhythm or periodicity.

When the word cycle is modified by a time interval such as 6-year cycle, 20-month cycle, 17-day cycle, the phrase usually means a cycle that recurs with reasonable regularity. In other words, it denotes rhythm.

Rhythm, coming from a Greek word meaning measured time, implies a beat, or a tendency toward perfect regularity or periodicity. It is what we really mean on most of the occasions when we use the word cycle.

Cycle analysis, as we are using the term in this bulletin, should really be called rhythm analysis, as we are concerned with **rhythmic cycles**--cycles that recur with a beat.

Periodicity, in the strict sense, is the quality of being regularly recurrent. It is a quality not often found in nature. The ideal cycles which are often added to a chart to diagram a rhythmic cycle are true periodicities.

A **wave** is one single cycle or undulation. Waves have **frequency**, **amplitude**, **period**, and, at least when they represent harmonic curves, **phase**.

Frequency is the number of complete vibrations to and fro--i.e. waves--per second It is a term not used by cycle analysts when dealing with cycles that are over a second in length.

Amplitude is the extent of a vibratory movement measured from the average position to an extreme position; that is, it is the height or depth of the wave above or below the axis around which the wave oscillates.

Positive amplitude is the distance above the axis, **negative amplitude** is the distance below the axis, **overall amplitude** is the sum of the positive and negative amplitudes. Amplitudes may be expressed in absolute units or as a percentage of the value of the axis.

Period is the interval of time required for a periodic motion to complete a cycle and begin to repeat itself. It is the length of the wave from crest to crest or trough to trough or from some other point on the curve taken as the **epoch**. The **epoch** is the point on the curve chosen as the beginning of the wave. In physics and astronomy it is usually taken as the point where the curve crosses the axis on its upward motion, but it may be any other point as well.

Phase, in a simple harmonic curve, is the point or stage in the period to which the oscillation has advanced considered in relation to a standard position or assumed instant of starting. It is measured along the axis, usually in degrees. By extension of meaning, **positive phase** is therefore the part of the wave above the axis or trend, and **negative phase** is the part of the wave below the axis or trend. When the crests (or troughs) of two or more different series of waves come at the same time, the waves are said to be **in phase** with each other. When the crests of one series of waves coincide with the troughs of another series, the series are spoken of as in **reverse phase**.

A **simple harmonic curve** referred to once or twice above, is the curve you would get by tracing the motion of a pendulum upon a piece of smoked paper that was moving at uniform speed at right angles to the direction in which the pendulum was swaying back and forth. It is perfectly simple, regular, and symmetrical and, in mathematical study, is usually referred to as a **sine curve**. A single oscillation is called a **sine wave**.

A **rectilinear** or **saw-tooth wave**, on the other hand, is a wave the sides of which are straight lines; in other words, zigzag.

Trend is the tendency of data in a series to increase or decrease during a long period of time. The expression, "a long period of time," cannot be defined except relatively. If you are dealing with hourly figures, you might consider trend as the general direction over the past 30 or 40 hours. With yearly figures "trend" might mean the general tendency over the past 100 years or more.

An **average** is a typical value which tends to sum up or describe a number of figures. There are at least five different kinds of averages commonly used by statisticians; but the one which ordinary folk think about when they hear the word **average** is the one computed by adding all the items together and dividing the total by the number of items. Thus, if we have four items, 10, 12, 11, and 13, the average of these items is 10 + 12 + 11 + 13 (46) divided by 4, or 11½. An average of this sort is more accurately called the **arithmetic mean**.

An arrangement of numbers is called a **series**.

When the numbers with which we deal represent events which occur one after another in time, the arrangement is called a **time series**. Thus, in the example above, if 10, 12, 11, and 13 represent the price of cotton for each of four consecutive years, or represent the number of accidents on each of four consecutive days, you would call the numbers by this name--a time series.

You could still average the numbers and say, for example, that the average price for all four years was 11½ cents, or that during the period there was an average of 11½ accidents per day, as the case might be.

You could also say that the average price for the first three years was 11 cents, (10 + 12 + 11 (33) divided by 3) and that the average price for the last three years was 12 cents (22 + 11 + 13 (36) divided by 3).

A **moving average** is a succession of averages secured from a series of numbers by dropping the first number (item) in each group averaged and including the next number in the series after the group, thus obtaining the next group to be averaged, and so on.

Thus, when you averaged the first three numbers of our time series (10, 12, and 11) and got 11, and then dropped the first number (10) and added the fourth number (13) and averaged again and got 12, you were constructing a moving average

Because you were averaging three items at a time, you would call the result a 3-item or 3-term moving average. If the items represented yearly values you would call the result a 3-year moving average. If the items represented daily values, you would call the result a 3-day moving average.

The **moving total** is the series of successive totals from which the moving average is computed. For example: When , above, you added 10, 12, and 11 to get 33, and then added 12, 11, and 13 to get 36 (as a step in the task of getting 11 and 12, the two terms of the moving average), you were computing a moving total.

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